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The Engineering and Mining Journal

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Concrete in Mining

An interesting feature in mining developments within the last few years is the increasing use of concrete in underground construction. While it is not positive that the Lake Superior copper and iron districts were pioneers in this use of concrete, it is certain that long strides have been made in its application in those fields. Introduced there at first sparingly and with many misgivings, in certain branches of construction it has become the standard practice and the field of its application is being constantly widened.

The factors governing the use of concrete underground, considered broadly, are probably the same everywhere; it must serve its purpose equally as well or better than the material for which it is being substituted, and the cost must not be prohibitive. Considering the first of these, concrete is usually required (1) to resist pressure, or the wear and tear of underground usage or both; and (2) to create a fireproof structure. The latter is an especially desirable feature in the case of shafts. To meet these requirements, it is now being used satisfactorily in the above-named districts for solid shaft construction, shaft lining, shaft rail stringers, timbers, etc., and in some cases for timbering lateral openings and shaft stations. It has been applied equally well to both circular and rectangular shafts.

Considering the second factor, cost, this depends principally upon the supply of labor and material. It is believed that the labor generally available at mines can be trained without difficulty in the proper handling of concrete. The supply of material, such as suitable sand, rock, cement, etc., is probably the most important factor. That the almost unlimited and therefore cheap supply of rock, sand and reënforcing materials is largely responsible for the extensive use of concrete in the Lake Superior country, there can be little question. At the same time it is hard to understand why concrete is not more extensively used in other districts, especially since it is so widely used in surface construction. Old material such as discarded hoisting ropes, mine rails, etc., forms admirable reënforcements if carefully used, and waste rock in many cases is suitable for mixing purposes. That it is coming into more general use for such work is indicated by recent or contemplated installations in some of the Western properties, notably that of the Old Dominion where it is proposed to line a shaft with concrete for over 1000 ft. Its especial recommendation is the proof against fire and this should go a long way toward overcoming the usual objections to initial cost, which is generally higher than for other materials.

Massachusetts Institute of Technology

The City of Cambridge, Mass., having complied with the request of the Massachusetts Institute of Technology that Amherst Street be closed, the Institute is now in a position to exercise its options on the new site on the embankment of the Charles River and doubtless will do so and proceed with its plans for building. This famous institution, which has outgrown its birthplace in Boston, has acquired a noble and inspiring site, the 50 acres of which will afford reasonable room. It has been materially aided in its program by the munificence of T. C. DuPont, the president of the powder company, himself an alumnus of the Institute, who has promised half a million dollars to his *alma mater,* and, it is to be inferred, approves the choice of a new location.

The removal of the Institute to Cambridge, the historic home of Harvard University, will recall the plans of a few years ago for an amalgamation of these two institutions of learning. Harvard was willing and so was the corporation of the Institute, but the alumni of the latter were not and their opposition ended the matter. Sentiment is almost always bound to meet with approbation—anyway, it is

not a thing that ought to be trod upon ruthlessly—but, certainly there is something jarring to the economic sense in the sight of two great colleges duplicating equipment, staff, and other things in Boston and environs, and now to be in the same city.

College Men Underground

A larger proportion of the graduates of the mining schools are turning to an apprenticeship underground as a working miner when they graduate from college. This is well, as it cannot but result in more progress in mining methods, and especially in the manner of dealing with labor problems, many of which have been aggravated by the fact that for a time after mining developed beyond the scope of the ordinary man that had worked his way up by the way of practical experience, engineers were put in charge with good technical training but with little first-hand experience as working miners. These men, therefore, are likely to look upon the labor question from a rather one-sided viewpoint. Owing to the fact that corporate ownership has become more typical than individual ownership of mines, the bond of personal contact and understanding between owner and miner has disappeared, and the man on day's pay likes or dislikes the company just in the same degree that he likes or dislikes the force of men in charge of the operation of the mine. Consequently, anything that will bring the men who in the future are to represent the owning companies into closer understanding and greater sympathy with the men earning their living on day's pay, either in the mine or at the mill or the smeltery, cannot help but result in mutual gain.

But the development of the college man who, after his technical training, sought promotion along the practical, in contradistinction from the technical side, as represented by the engineering and assaying departments of the mining force, has until recently been somewhat hampered by the fact that there were no intermediate steps between miner and assistant superintendent.

The low prices for the metals that have prevailed for the last two years have caused mining companies and mining men to study costs closely, and as a result there has come a general appreciation that the greatest chance for improvement in mining economy is in the work underground. Scientific management is now almost oozing out of the air in all branches of engineering, and its application in the mining field is opening up to the technical graduate the intermediate positions necessary to his gradual development into a good assistant superintendent and the higher positions in the operation of mines.

Now, before drills are bought, competitive tests are becoming characteristic of the operations of the larger companies, and so with other machines and supplies used underground. These tests are generally overseen by young college men who have worked up from miners to such an opportunity, and this watching of the tests brings the young mining student into closer contact with the mine foreman and shift bosses, from whom he absorbs the finer points in the practical details of mining the ore and getting development work done cheaply; it also throws him into closer relationship with the mine superintendent and even the manager in the discussion of the economic side of the work, and he absorbs from them a knowledge of the higher points in mine operation that only come after long experience in facing difficult problems.

At the Superior mine, near Houghton, Mich., a college man is employed whose duty it is to inspect the machine drills and other equipment, and see that they are in an efficient condition. Among the miners he has come to be known as the "machine doctor," as he is the one who prescribes for the machines and sends them on top for the prescriptions to be filled in the machine-shop dispensary. Most of the mining is done on contract at that mine, and this man also measures up the stopes of the different contractors each week and computes the money earned by each party of miners. The amount of these earnings is posted in the change house weekly, where every miner can see them. As a result there has grown up a strong rivalry among the men to head the list in regard to earnings each week. Consequently, the miners take more interest in their work, and the company is greatly benefited, as under this stimulus the efficiency of its miners improves. Under the "machine doctor" are several college men who have gained practical experience as working miners. These men are kept busy testing out new equipment or proposed changes in the mining work; and also in checking changes in working conditions as claimed by any of the contractors.

Thus, through the interest that is being aroused in scientific management, an opportunity is being provided for college men to work up gradually to positions of high responsibility along the purely operating side of mining without running a transit or sweating over crucibles, as has been the time-honored route in the past. This cannot help but be of great benefit to mining, and should also have a far-reaching effect in developing more cordial relations between the employees and the operating staff of the company.

Principles of Mine Management

Noteworthy activity was manifest in Colorado in the last year in the attempts to restore the state to its former place among the metal producers or at least to stay the decline. One means of increasing the activity is, of course, to find new orebodies. To this end the "Grubstake Fund" was founded by public-spirited people. This furnished an incentive to prospectors to make diligent search for deposits heretofore overlooked. Last summer found many of these searchers in the field and some claims were located that apparently have justified the formation of the Colorado Grubstake & Mining Co., the purpose of the latter being to develop them further.

Another method of adding to the production, and one which is in keeping with modern tendencies, is by the increased yield to be obtained from more efficient mining and milling processes. A movement tending to accomplish this object was recently inaugurated in Colorado, the plan being to provide a means by which those who are interested directly or indirectly may learn the basic principles upon which successful mining and metallurgical operations are founded.

The first in this series of "Practical Talks," as they are called, was given by Charles A. Chase, at Idaho Springs, on the subject of "Mine Management." In this paper, which appears elsewhere in the JOURNAL, Mr. Chase gives a particularly clear diagnosis of many ailments of the mining industry. The remedies outlined impress us as being both safe and effective.

Correspondence and Discussion

Design of Charcoal Assay Furnace

In the article "Makeshift Assaying for Prospectors," published in the JOURNAL of Dec. 23, 1911, Arthur O. Christensen states, in referring to the use of charcoal as a fuel: "It must always be borne in mind that the heat for the fusion is not from the flame, but the radiated heat from the glowing coals or the heated sides of the furnace." I once thought the same myself, but an experience proved that it all depends upon the charcoal.

In Central America I had occasion to design and build a small, muffle assay furnace in which charcoal was to be used. I had used charcoal made from hard woods, oak and chestnut, for similar purposes elsewhere, and obtained the best heat when the muffle was embedded in the coals.

So I designed a vertical shaft of brickwork, square in section, which terminated in a brick stack. The aim was to make the furnace simple in construction so that the native masons would experience no trouble in building it. At about the center, the muffle was supported. Above was a door for feeding charcoal and below an ashpit, just above the top of which the grate bars were supported.

The principal available wood for charcoal making was pitch pine. A large hearth, 30 ft. in diameter, was prepared and the logs cut in 4-ft. lengths, which were stacked vertically in three tiers. I had quite an argument with my foreman about some 18-in. logs he was using.

The coal was fired Friday afternoon and the pile opened Sunday night. I had never seen a pile of charcoal so reduced in bulk during the burning, nor one burned so rapidly or that produced so much tar. I expected that most of the wood would be reduced to ashes after such fast burning, but was surprised to find that we had an excellent, though light, charcoal.

I started the fire in my assay furnace, embedded the muffle in a deep layer of fuel, expecting to produce a bed of hot incandescent coal that would heat the muffle with which it was in contact. Instead, that charcoal burned furiously under the chimney draft with a long flame that fused the surface of the brick above the muffle and the lower part of the chimney. The muffle was hardly hot enough for cupelling.

Fortunately I could easily rearrange the grate bars, so as to give a foot greater depth below the bottom of the muffle. The bed of fuel was then carried so that only the flame enveloped the muffle. The muffle could then be kept as hot as desired and the upper part of the furnace remained comparatively cool.

The ash of the coal, and I have observed that most woods in the tropics produce ash having the same property, fused to a black, sticky mass, which clogged the grate bars and, if it had been in contact with the muffle, would have caused trouble by sticking. After that experience I made an entry in my notebook to the effect that in designing an assay furnace in which charcoal is to be used, first determine whether the coal burns with a long flame or short, then build the furnace so that the muffle will be heated by flame or contact with the hot coals, according to the way the fuel burns.

CLARENCE C. SEMPLE.

New York, Dec. 24, 1911.

Views, Suggestions and Experiences of Readers

Timber Headframes

In the JOURNAL of Dec. 2, 1911, there is a description of a simple timber headframe by W. R. Hodge. This type of frame is by no means a novelty in Mexico, there being many examples at El Oro, both at the Esperanza and El Oro mines.

I do not know if there is in reality a less quantity of timber used, for, as may be seen on reference to the drawing given, by eliminating the front leg and bringing forward the middle member to a vertical position the design will be that of the usual headframe with actually less timber.

To economize timber why not dispense with the ground sills, replacing them with cast-iron sockets, bolted to the concrete pillars, in which the ends of the posts rest? We all know that the sills are the first timbers to rot, especially when laid near the surface of the ground. The chief advantage of this type of frame consists in the clear space around the shaft, especially if the sill is eliminated. The weight is also carried on firm ground, some distance from the shaft collar, which at times is an advantage.

In designing a frame of this type at El Oro, in 1907, in rather heavy work, the middle post was composed of four pieces of 12x12-in. pine bolted together. The other posts were of smaller dimensions, 8x8 and 10x10 in. This gave a rigid structure, all but free from vibration when hoisting at 100 ft. per min. with cages and 30-cu.ft. cars. H. E. WEST.

Cornwall, England, Dec. 12, 1911.

Flotation at Zinc Corporation

In the article on "Flotation at Zinc Corporation, Ltd.," by D. P. Mitchell, published in the JOURNAL of Nov. 18, 1911, it is stated that—"Minerals Separation frothing patents embodying flotation by the use of oil, acid and air" were followed by "Elmore's patent of the vacuum process using oil, acid and air." This statement is contrary to the facts. The Elmore patent is of prior date to the Minerals Separation patent, as can readily be proved by consulting the printed specifications to which I beg to refer those interested.

In view of the Ore Concentration Co.'s firm determination to maintain its patent rights, it is advisable that engineers and metallurgists should be made acquainted with the real facts of the case so as to avoid misapprehensions on a matter which may be of serious consequence to them.

Further corrections in the same article need to be made. For instance, Mr. Mitchell says that the introduction of flotation processes into large plants resulted in great mechanical perfection and that the credit for the success of flotation as a new factor in metallurgy is as much assignable to the operators of these large units as to any or all of the patents. So far as the Elmore process and plant at the Zinc Corporation are concerned, the above assertions are absolutely incorrect.

The Elmore plant was installed about three years ago and worked continuously, yielding most satisfactory results—both technically and commercially—the profit during this period amounting to about $1,250,000. During the whole of this time there was not, practically speaking, a single bolt or nut altered in the whole of the Elmore plant *per se*.

Mechanical perfection of the Elmore plant had been attained long before our process was adopted by the Zinc Corporation, as is proved by the fact that the Ore Concentration Co. has a number of plants in use in different parts of the world, all of which are today in precisely the same condition as when originally erected by the company's engineers—in one instance over five years ago.

J. CROCKER.

Secretary, The Ore Concentration Co.

London, Dec. 16, 1911.

Reminiscences of Yukon Gold

Thomas W. Lawson, of Boston, was a witness on Dec. 19 in the Beatty-Guggenheim suit, and gave some interesting testimony regarding the Yukon Gold campaign which he conducted so spectacularly. It will be remembered that initially the Guggenheims denied knowing Mr. Lawson in the matter. In an editorial in the JOURNAL, of Apr. 4, 1908, surprise was expressed that "the Guggenheims should have departed so far from their previous methods as to undertake to market 700,000 shares with the aid of Mr. Lawson." It was stated further that "they did not negotiate directly with Mr. Lawson, another party standing in between."

At the trial, there was offered as evidence the contract of Mar. 10, 1908, between William B. Thompson and the Yukon Gold Co., but this was objected to by the defense on the ground of immateriality, Justice Gerard sustaining the objection.

"I observe," said Attorney Wollman to Mr. Lawson, "that this contract was made in the name of William B. Thompson. State whether or not he was acting for you or you were using his name in the making of this contract." Objection by the defense, which was sustained.

Mr. Lawson said he had during March, 1908, several conversations with Daniel Guggenheim, who wanted him to begin a campaign for the sale of Yukon Gold stock to realize about $3,000,000 for machinery, mining and development. Money was rather tight at the time and Guggenheim did not care to attempt to raise this sum in other ways and thought that the witness could perhaps sell the stock. Mr. Lawson said he insisted on knowing who had an interest in the company before he undertook the campaign, so that stock might not be unloaded to lower the price after he had made promises regarding the figure it would sell for on certain dates. Guggenheim told him that Beatty, among others, was interested. To obtain some idea of Beatty's faith in the ultimate success of the enterprise, Mr. Lawson wished to know whether this was merely promotion interest or whether Beatty had invested his own money, and was informed by Guggenheim that Beatty had invested money at the start and subsequently during the uncertain period. Guggenheim told him, Mr. Lawson said in response to questions, that Beatty was not bound by any agreement not to sell his stock, and on that ground Mr. Lawson said he declined to manage the stock-selling campaign. He said in explanation:

"I knew Beatty was an independent chap and one who would sell what he owns, stocks, bonds, or mining properties, when he saw fit to."

"Irrespective of the desires or interests of his associates?" asked Louis Marshall, lawyer for the Guggenheims.

"Oh, no," said Mr. Lawson. "If Mr. Beatty had been a party to an agreement between Daniel Guggenheim and myself I would have been thoroughly satisfied."

"You had in mind, then, that the interest of Mr. Beatty was a considerable interest?" asked Mr. Marshall.

"I don't know that I would call it very considerable, but I had it in mind that it was quite a few shares."

John Hays Hammond testified that he was informed that Beatty had provided some of the money to help Perry retain the options and was interested with Perry in the scheme subject to the acquiescence of Guggenheim, Hammond and the others. Mr. Hammond stated that the matter had been discussed with Danial Guggenheim, who was told that Perry and Beatty were jointly interested in the profits to be derived from whatever transaction took place out of the Yukon situation. Mr. Hammond testified further that the matter of Beatty's interest with Perry had been discussed by the directors and that he was instructed by Guggenheim to settle with Perry on the basis of 4% instead of 5% originally talked of, provided Beatty were not allowed to participate in the Northwest Hydraulic, a company eventually merged into the Yukon Gold Company.

Proposed Legislation Affecting Mining

WASHINGTON CORRESPONDENCE

A bill (S. 4002) has been introduced in the Senate by Senator Nixon directing that all public lands containing deposits of borax shall be subject to location, entry and patent under the placer-mining laws of the United States.

In the House a bill (H. R. 16,220) has been introduced by Representative Martin, of South Dakota, for the establishment of mining experiment stations in the states producing or containing exploitable deposits of ore, which stations are to be in charge of a geologist and a chemist under the direction of the Secretary of the Interior. The purpose of the stations will be to obtain reliable geological information as to the occurrence and to make analyses and assays of the ores.

Relative to agricultural entries on coal lands an amendment (H. R. 16,448) to the act of June 22, 1910, has been introduced by Representative Hanna directing that the unreserved public lands of the United States exclusive of Alaska, which have been withdrawn or classified as coal lands, shall be subject to entry under the homestead laws, the desert-land laws, to selection under the Carey Act and to withdrawal under the Reclamation Act, wherever such entry is made with the object of obtaining title, with a reservation to the United States of the coal in such lands and of the right to prospect for it.

The establishment of a mine-rescue station at Barbourville, Ky., and appropriation of $20,000 for its equipment was asked for in the House (H. R. 16,287) by Mr. Powers. Also a bill (H. R. 179) was offered by Mr. Austin for providing $150,000 to be spent as directed by the Secretary of War for relief to the sufferers of the Briceville, Tenn., explosion.

A Senate bill (S. 3843) has been introduced by Senator Owen for granting to coal companies in the State of Oklahoma the right to acquire land adjoining their mine leases on the land occupied by the Choctaw and Chickasaw Indians.

Potash in Pacific Coast Kelps

WASHINGTON CORRESPONDENCE

Secretary of Agriculture James Wilson has just sent to the President a special report on the use of the $12,000 which was entrusted to him by Congress last year for the purpose of looking for a supply of potash. Mr. Wilson's report optimistically asserts that "in the giant kelps of the Pacific Coast a satisfactory source of potash has been found. The kelp groves along less than one-fourth of the coast line have been mapped and these should yield from two to three times as much potash as the present importations. These sea weeds are able to extract, by selective absorption, the potash salts from the sea water and on drying, these salts are largely exuded on the surface. The dried plants contain from 25 to 35 per cent. of their weight of potassium chloride and the latter can readily be extracted. The kelps also contain iodine and many other byproducts can be obtained from them. It is possible that these byproducts will more than pay the manufacturing expenses, leaving the potassium chloride free from cost. The Japanese have already shown considerable ingenuity in working up these byproducts. Not only do they use some of the waste material for cattle food but the Japanese themselves use it as a staple article of diet. Glue, shellac, paper and other useful products can also be made."

"Some of the Pacific groves are five miles long and two miles wide, and the growth in these groves is exceedingly dense. The two principal species that would be available are *Nereocystis luet Keana* in the north and *Macrocystis pyrifera* in the south. Both these plants reach a length of 100 ft. or more and grow in strong tideways or where they are exposed to the full force of the open sea. All of the groves are within the three-mile limit and should be easily harvested. The heaviest groves are south

of Point Sur but large ones extend as far north as Seattle. If properly harvested and protected these groves will yield an annual harvest indefinitely; it is even possible that in the case of *Macrocystis* two such harvests may be obtained. On a conservative basis upward of a million tons of potassium chloride worth nearly $40,000,000 should be obtained each year. No estimate can be given at present of the value of the byproducts."

Iron Ore Ownership in Michigan

NEGAUNEE CORRESPONDENCE

Congressman Young, representative from the upper peninsula of Michigan and one of the members of the Stanley Steel Committee, has presented to that body figures showing the relative amount and value of iron ore in Michigan mines owned by the U. S. Steel Corporation and by other companies. Mr. Young's figures are based on the report made to the Michigan Tax Commission by J. R. Finlay, mining engineer, of New York, who was assisted by Dr. C. K. Leith, of the University of Wisconsin.

The total tonnage of known iron ore in Michigan, shown by mining and drilling operations, is 189,953,164 tons. Of this, the U. S. Steel Corporation, through the Oliver Iron Mining Co., owns 28.9%, and the other 71.1% is owned by independent companies. The present value of the total ore, figured at the present value of annuities, which represent the expected profit for the number of years for which each mine can produce, is $118,668,000. Of this, the Oliver Iron Mining Co. has 35.9%, and the independent companies 64.1%. These figures are a surprise to many mining men, as it was thought that the Steel Corporation's holdings in Michigan were more extensive. On the Marquette range, the Oliver Iron Mining Co.'s holdings are exceeded by those of the Cleveland-Cliffs Iron Co.; in addition, the Breitung-Kaufman interests, the Jones & Laughlin Co., M. A. Hanna Co., Republic Iron Co., and the Republic Iron & Steel Co. have extensive holdings. In the Iron Mountain district of the Menominee range the Penn Iron Mining Co., a subsidiary of the Cambria Steel Co., has large interests; in the Crystal Falls district Corrigan, McKinney & Co., are the dominant interests; in the Iron River district about 15 different companies are developing mines, and the largest holder is probably Pickands, Mather & Co. On the Gogebic range the Newport Mining Co., Pickands, Mather & Co., Corrigan, McKinney & Co., and the Oglebay-Norton interests own large orebodies.

Characteristics of Solid Bitumens

The accompanying table shows the chief characteristics of the principal varieties of solid bitumens. It is prepared under the direction of Dr. David T. Day, of the U. S. Geological Survey, in connection with a report on the production of asphalt and related bitumens. The most important of these hydrocarbon compounds is gilsonite, of which 29,832 tons were mined in 1910, valued by the Survey at $372,900. This production was chiefly from the Uinta district in Utah.

CHIEF CHARACTERISTICS OF THE PRINCIPAL VARIETIES OF SOLID BITUMENS

Name	Common Name	Specific Gravity	Color	Fusibility	Solubility					Composition			
					In Gasolene (of 76 deg. Baumé)	In Ether	In Carbon Bisulphide	In Carbon Tetrachloride	In Turpentine	S, Per Cent.	O, Per Cent.	C, Per Cent.	H, Per Cent.
Uintaite	Gilsonite	1.068 to 0.170	Brilliant black powder. Streak lighter brown, than albertite.	Easily fusible in candle flame; burns and acts like sealing wax, leaving sharp impression.	Soluble in petroleum ether.	Slowly; not wholly soluble as a powder.	Entirely soluble.	Almost entirely soluble.	Freely soluble in hot turpentine; less soluble in cold turpentine.	1.55	.....	88.79	9.31
Wurtzilite	Elaterite, Tabbyrite, Aeonite, Aegerite	1.0227	Jet black by reflected light; deep red in thin plates.	Nonfusible in hot water, but softens, toughens and becomes more elastic. In candle flame softens and melts and burns with bright flame.	Practically insoluble.	About 4 per cent. soluble.	Partly soluble.	Slightly soluble.	Fairly soluble.	5.83	.....	80.00	12.23
Wiedgerite[1]	Mineral Liver	1.02	Liver brown	Soft; not as elastic as rubber.	Soluble	Soluble	Soluble	Soluble	Soluble				
Grahamite	Grahamite	1.145	Black, but powder and streak chocolate brown.	Melts imperfectly with decomposition of surface; in this state the interior may be drawn into threads.	Partly soluble.	Partly soluble.	Readily soluble.	.....	Swells and nearly all dissolves.	Tr.	13.46	76.45	7.63
Impsonite[2]	.....	1.175	Jet black	Does not soften in boiling water.	Insoluble	5 per cent. soluble.	Completely soluble.	Partly soluble.	Almost insoluble.	1.47	2.00	86.57	7.26
Albertite	Albertite	1.08 to 1.11	Black; streak black; powder black to dark brown.	In spirit flame intumesces and emits gas, but does not melt; melts in closed tube.	.....	About 4 per cent. soluble.	Partly soluble.	Partly soluble.	30 per cent. soluble.	Tr.	1.97	86.04	8.96
Ozokerite[3]	.....	0.85 to 0.95	.....	Fuses at 56 to 70 deg. F.	Soluble	Some varieties wholly soluble.	Soluble	Soluble	Soluble	Tr.	Tr.	85.25	15.09
Oil asphalt	.....	0.9825	Brownish black	.....	90 per cent. soluble.	90 per cent. soluble.	99.9 per cent. soluble.	99.9 per cent. soluble.	99.9 per cent. soluble.	0.30	.....	84.1	15.2
Refined bitumens	A	1.008	Black	Melts in hot water	80 per cent. soluble.	80 per cent. soluble.	99.9 per cent. soluble.	99.5 per cent. soluble.	99.5 per cent. soluble.	0.35	.....	84.7	14.7
	B	1.023	Black	Softens in hot water; does not melt.	75 per cent. soluble.	76 per cent. soluble.	99.8 per cent. soluble.	99.2 per cent. soluble.	99.5 per cent. soluble.	0.40	.....	85.1	14.3
	C	1.039	Black	Softens in hot water; melts in candle flame; tough and pliable at ordinary temperatures; brittle in very cold weather.	70 per cent. soluble.	73 per cent. soluble.	99.7 per cent. soluble.	99.0 per cent. soluble.	99.5 per cent. soluble.	0.43	.....	85.5	13.9

[1] An impure soft mass, containing much sulphur and water. Turns black on exposure. Has not yet been carefully described. [2] See description by J. A. Taff, Bull. 380, U. S. Geol. Surv., pp. 286-297. [3] Black from contained asphalt.

Proposed Mineral Law Changes

WASHINGTON CORRESPONDENCE

At a recent conference of Secretary of the Interior Fisher, Senator Smoot and E. B. Kirby, representative of the American Mining Congress, Secretary Fisher unofficially expressed his approval of a resolution which it is proposed to introduce at this session of Congress. This resolution provides for the appointment of a commission made up of mining experts to hold meetings and to take testimony and make a report suggesting a general revision of the mining laws to meet existing conditions.

Rumor of Shell Co. Purchase in Midway Oil Field

It is reported in the Midway field that the Rothschild interests in the Royal Dutch Shell Co. have bought the Bear Creek and Mammoth properties, says the San Francisco *Chronicle*, but the report has not been confirmed. It has been understood for nearly a year that this company was about to enter the California field in competition with the Standard, the Associated and the Union, and the movements of that company during the last few months give the report an air of plausibility. It is said that the fear of this competition has prevented the big marketers from cutting the price of oil at the well below 30c., and any lowering of that price would invite a most vigorous competition. At 30c. at the well there is a great profit to the refining companies, for the prices of gasoline, kerosene, benzine and lubricants have not been lowered in proportion to the decrease in the cost of the raw material. This consideration of a strong competitor entering the California field has filled the hearts of the producers with joy, and they are confidently predicting that the price of the product at the well will not be lowered to any material extent.

Vanadium ore has been found at Camp Signal in San Bernardino county, California, in the property of the Dirigo Mining and Milling Company. Samples are coated with a deposit of cuprodescloizite. The associated lead minerals are cerussite and vanadinite, from which the cuprodescloizite seems to be derived.

Graphic Methods for Niter-Assay Calculations

By Philip D. Wilson*

With the increasing tendency toward the use of the niter method in the gold and silver assay of sulphides any means of facilitating the preliminary calculations becomes of great value to the laboratory where a large number of assays is made daily. In the practical application of the method a preliminary fusion is necessary on ores whose composition is not approximately known, and from the lead button obtained the calculation is made of the niter necessary in the charge to yield a suitable button. In a sulphide ore, uncontaminated with much arsenic, antimony, bismuth or copper, the preliminary fusion may be dispensed with if the sulphur tenor is known, but an estimation of the sulphur percentage from a vanning test of the ore is hardly precise enough.

Sulphur-niter Graph of Great Assistance

In some offices the laboratory equipment includes a balance, graduated to read grams of niter necessary for 0.5 assay ton of ore when the button obtained from a preliminary fusion on 0.1 assay ton is placed upon the scale pan. This relieves the assayer of all calculations and deserves a more extended application. But in those laboratories where such a balance is not available a diagrammatic method of obtaining the same result will prove valuable. Curves may be plotted with the sulphur percentages as abscissae so that the amount of niter may be obtained directly when the sulphur contents of any product is known.

The calculation of the amount of niter to yield a 20-gram button from 0.5 a.t. of ore, when given the weight of the button obtained from 0.1 a.t. of ore, is a simple one, if the oxidizing power of the niter in terms of lead is known. This is previously determined by a fusion against the reducing agent used, usually flour. In the present instance one gram of niter had an oxidizing power equivalent to 4.4 grams of lead. If we let K represent the required weight of KNO_3 for a 0.5-a.t. fusion and W the weight of the preliminary button from a 0.1-a.t. fusion,

$$K = \frac{5W - 20}{4.4},$$

which reduces to $K = 1.14\ W - 4.56$. The locus with K and W as coördinates will obviously be a straight line.

Since a poor fusion and unreliable results accompany the use of more than 20 or, at most, 25 grams of niter in a 0.5-a.t. charge, it becomes necessary to use smaller portions of heavy sulphide ore, or to resort to roasting or the iron-nails method. With excessive copper, too, smaller portions are necessary unless scorification is to follow. Thus a curve may be drawn similarly for use with 0.25 a.t. of ore. In this case

$$K = \frac{2.5W - 20}{4.4} = 0.57W - 4.56.$$

When smaller buttons are required, as is the case when two are to be scorified together it is a simple matter to add sufficient niter in excess of that indicated on the diagram to reduce the button from 20 grams to the requisite size.

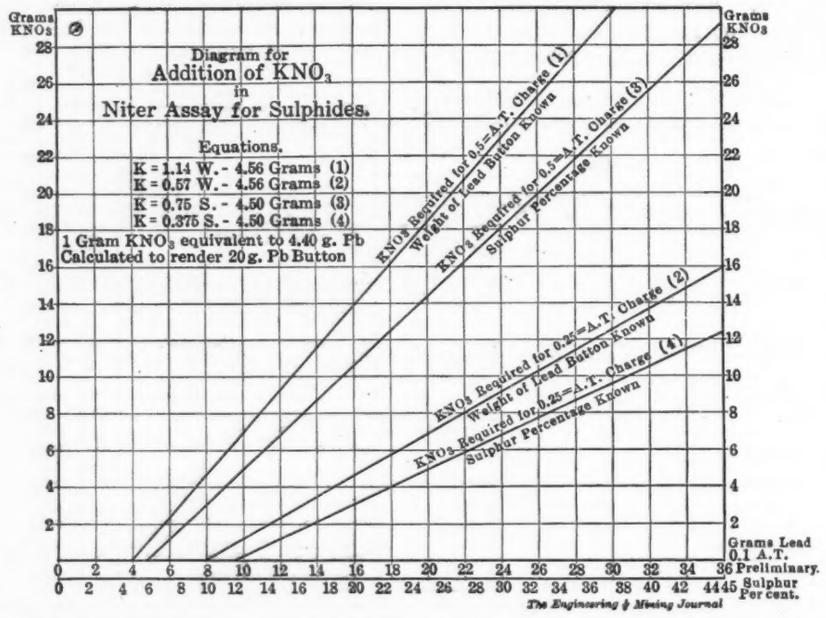
In order to obtain an equation between the sulphur percentage and the requisite amount of niter it was necessary to determine the reducing power of sulphide sulphur in terms of lead under practical fluxing and fusing-temperature conditions. A long series of fusions was made on ores ranging from 2 to 50 per cent. sulphur determined by wet methods, fluxed so as to give approximately a sesquisilicate slag, $4RO.3SiO_2$, in which the ratio of PbO to $HNaCO_3$ in the charge was approximately 2½ to 1. With the heavier sulphides a monosilicate slag, $2RO.SiO_2$, was approached and the ratio of PbO to $HNaCO_3$ somewhat increased in order to make the sulphur elimination more perfect. The average result obtained in these tests indicated that one gram of sulphur, combined as pyrite or chalcopyrite, will reduce 23 grams of lead. This is equivalent in 0.5 a.t. of ore to a reducing power of 3.3 grams lead for each per cent. of sulphur. Thus if S represent the sulphur per cent., and 6 per cent. is allowed as necessary to reduce the requisite 20-gram button, the required relation will be expressed by the equation,

$$K = \frac{3.3}{4.4}(S - 6) = 0.75\,S - 4.50.$$

Similar reasoning will deduce the equation when 0.25 a.t. of ore is used for assay as $K = 0.375\ S - 4.50$. As before, these are the equations of straight lines and may be easily plotted as shown.

The only variable element in these equations is the lead equivalent of the niter. This varies in the commercial material from 4 to somewhat over 5 grams. But with the graphs plotted for one value it is a simple matter to correct the diagrammatic result with a suitable factor for each new lot of reagent used. Thus if 10 grams of 4.4 niter are required from the diagram the necessary amount of 4.8 niter will be $\frac{4.4}{4.8} \times 10$ grams, or 9.16 grams.

In using such a diagram the assayer must bear in mind the fact that variations in fluxes and temperatures of fusion have an appreciable effect upon the size of the button. An increase in soda in the charge over the amount indicated will increase the size of the button materially. An increase in litharge acts similarly but to a lesser degree. Excess silica reduces the weight of the button, although in an acid charge the oxidizing power of the niter is decreased to some extent. Furthermore, if the charge is fused at too low a temperature a larger button than the theoretical is obtained. A 30-minute fusion in a furnace or muffle at good, yellow heat gives the most satisfactory results. If due precautions and proper allowances are made a diagram such as that described will prove a time-saving element in the use of the niter method.


Grams KNO3
Diagram for
Addition of KNO3
in
Niter Assay for Sulphides.
Equations.
K = 1.14 W. - 4.56 Grams (1)
K = 0.57 W. - 4.56 Grams (2)
K = 0.75 S. - 4.50 Grams (3)
K = 0.375 S. - 4.50 Grams (4)
1 Gram KNO3 equivalent to 4.40 g. Pb
Calculated to render 20 g. Pb Button
KNO3 Required for 0.5=A.T. Charge (1)
Weight of Lead Button Known
KNO3 Required for 0.5=A.T. Charge (3)
Sulphur Percentage Known
KNO3 Required for 0.25=A.T. Charge (2)
Weight of Lead Button Known
KNO3 Required for 0.25=A.T. Charge (4)
Sulphur Percentage Known
Grams Lead 0.1 A.T. Preliminary.
Sulphur Per cent.
The Engineering & Mining Journal

The products of the clay-working industries in the United States—brick, tile, pottery, etc.—reached in 1910 the largest value ever attained, the total being $170,115,974, compared with $166,321,213 in 1909, according to the U. S. Geological Survey.

*Douglas, Ariz.

Details of Practical Mining

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

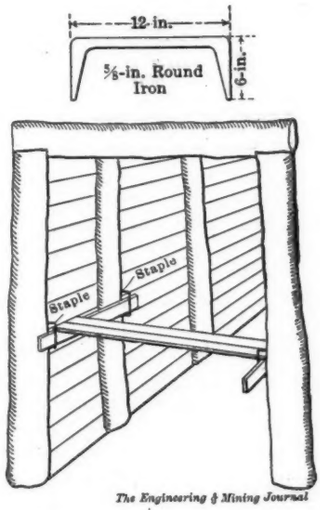
Notes of Interest to Prospectors and Operators of Small as well as Large Mines Things that have to be done in Everyday Mining

Staple for Mine Staging

BY W. R. HODGE*

For the high, hard-to-reach parts of timbered drifts it is necessary to erect a temporary staging when the lagging must be replaced or spiles be driven ahead. This staging usually consists of loose planks laid on 2x4 timbers spiked to the sets.

In many of the mines of the Mesabi range, instead of spiking planks to the



STAGING ERECTED IN A DRIFT

drift set to support the staging, the miners use a staple such as is shown in the sketch. Two of these staples are driven at a convenient hight in adjacent sets each side of the drift. A 2x6 plank is then slipped in each pair of staples and the foundation of the platform is ready. When the work is finished the staples are removed by a crowbar. This little device keeps the planks free of spikes and furnishes a safe platform for the timberman or miner.

*Mining engineer, Houghton, Mich.

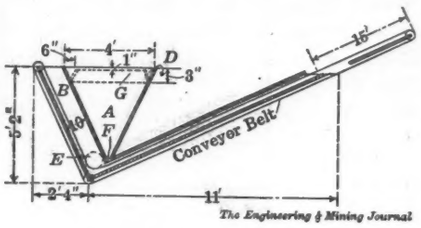
Handling Concentrates at the Daly-Judge Mill

BY CLAUDE T. RICE

The Daly-Judge mill at Park City, Utah, makes three classes of concentrates, a lead, a zinc and an iron-zinc product. These concentrates are handled automatically in a clever manner. The concentrates coming from the different tables flow to their respective launders, which are made of wood and lined on the bottom with galvanized iron. A grade of only 8 in. in 150 ft. is given to the launders, but as they are given a violent shake by means of the Wilfley head motions, having a 1-in. stroke, that are attached to their head ends, the concentrates travel rapidly along them. The three launders discharge to their respective bucket elevators.

Referring to the accompanying drawing, each elevator discharges into a settling box *A*, having a top baffle *G*. This box discharges the settled concentrates continuously on to an inclined traveling belt that operates in an auxiliary box *B C* that extends at each end to a height even with the top of the settler so that the water in the concentrates, while it works down with them into the conveyor box, can discharge only over the lip of the settler at *D*. One side of the conveyor box, *B*, hugs the side of the settler while the other, *C*, puts off at an angle of about 24 deg. from the horizontal. Two of the rollers around which the conveyor belt runs are above water, while one, *E*, is placed so as to cause the belt to pass close under the discharge opening *F* of the settler box.

The long end of the belt extends about 15 ft. beyond the level of the water in the conveyor box so that the concentrates have a good chance to drain as the belt is run at a speed of only about 50 ft. per minute. At the upper end the concentrates discharge into a bin with about 8 per cent. moisture. Experience has shown that the belts of these dewatering devices should have a lower slope and that the part out of water should be longer so as to get the best results. The overflow from the settler



CONCENTRATE DEWATERER

goes to a Callow cone and after being settled again, so as to guard against the loss of any slime concentrates, is returned for use on the tables. Four-ply rubber belts 20 in. wide are used in these dewatering devices. One of them will handle 17,000 tons of concentrates before it wears out.

Capacity and Speed of Belt Conveyors

The accompanying chart shows, almost at a glance, practically all data necessary in determining the speed, capacity and size of belt required for handling material, both sized and unsized, in lumps varying from 1½ to 14 in. in diameter, according to the practice of the Robins Conveying Belt Company.

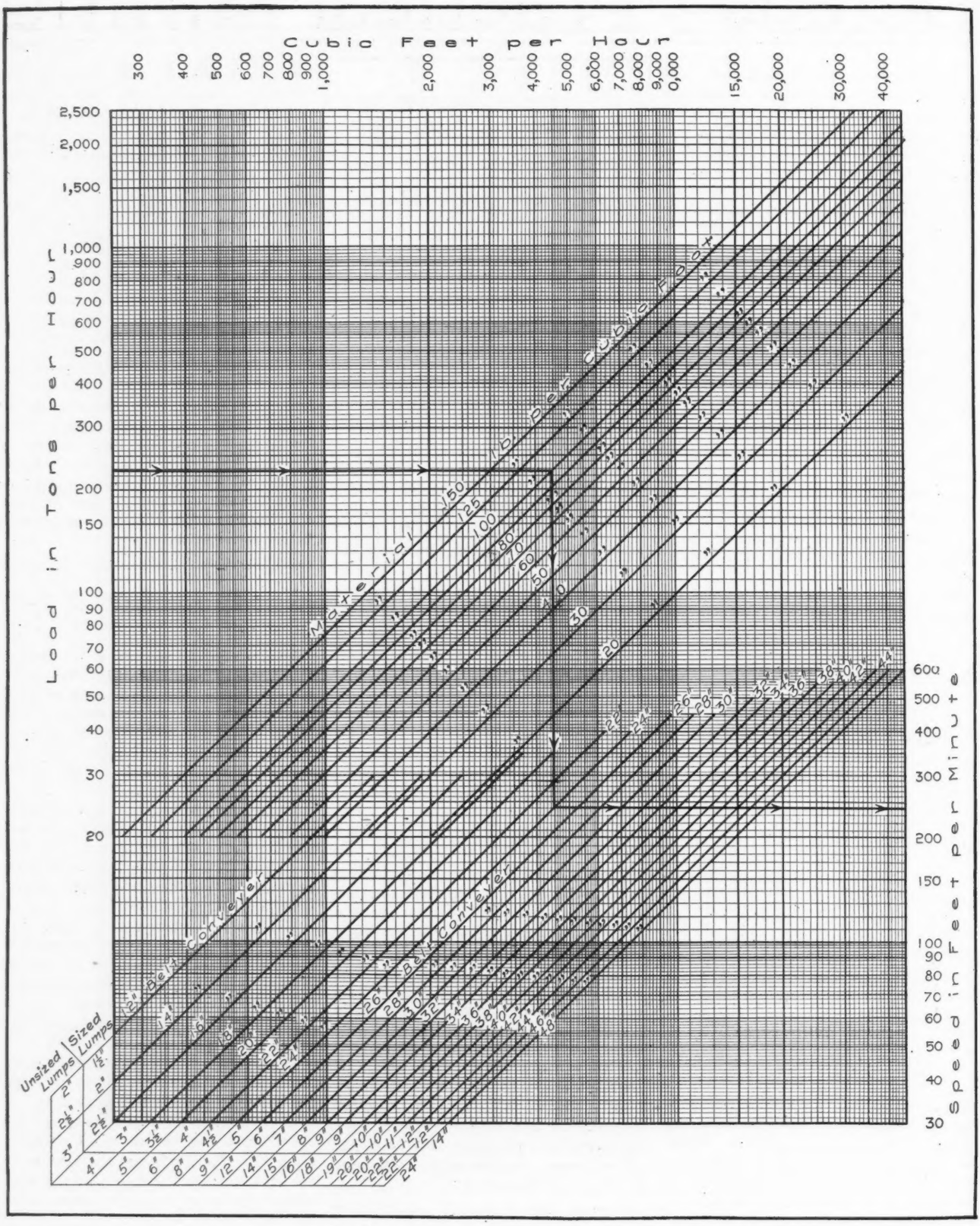
In the chart the vertical lines represent cubic feet of material handled per hour, as read from left to right, at the top. The horizontal lines, reading up, at the left of the chart, represent the weight of material handled in tons per hour.

Crossing the chart are two series of diagonal lines, the upper representing material of different density, varying from 20 to 150 lb. per cu.ft. The lower series of diagonals represents the required width of belt for any given capacity and speed.

On the right of the chart, reading up, is a scale giving the speed of the belt, for different widths and capacities. A close inspection of this portion of the chart shows that, for the same capacity, the speed of the belt varies inversely as the square of the width; or, for the same speed, the capacity of a belt varies with the square of its width.

For engineers who desire a formula, this relation of capacity (c), speed (v) and width (w) of conveyor belts is expressed as follows:

$$\frac{c_1}{c_2} = \frac{v_1}{v_2}\left(\frac{w_1}{w_2}\right)^2.$$



CAPACITY AND SPEED CHART OF BELT CONVEYORS

To find the width and speed of belt to move designed tonnage of given size or weight of ore, follow horizontal line of the given tonnage to intersection with one of the upper set of diagonals, then follow the vertical downward to intersection of second set of diagonals corresponding to any desired width of belt, then follow out horizontally to the speed scale, which gives speed for the belt.

In comparing two conveyor belts operating under like conditions and handling the same material, the tonnage ratio is always equal to the product of the speed ratio and the square of the width ratio.

For example, suppose a 16-in. belt, running at a speed of 150 ft. per min., delivers 60 tons of a certain material per hour, and it is desired to find the tonnage of a 40-in. belt, running at a speed of 80 ft. per min. Call the required capacity of the 40-in. belt x; then, applying the above formula,

$$\frac{x}{60} = \frac{80}{150}\left(\frac{40}{16}\right)^2 = \frac{8}{15}\left(\frac{5}{2}\right)^2$$

$$x = \frac{60 \times 8 \times 25}{15 \times 4} = 200 \textit{ tons per hour.}$$

The heavy line crossing the chart shows that a 24-in. belt would have to be run at a speed of 240 ft. per min., in order to handle a tonnage of 225 tons per hr. of material weighing 100 lb. per cu.ft. The two scales at the lower left-hand corner of the chart show what width of belt is preferable for handling different sizes of material, the inner scale being for lumps of a uniform size and the outer one for mixed material, the scale reading indicating the maximum size of lump. The heavy line just referred to is for a belt handling mixed material when the lumps do not exceed 8 in. With finer material when the lumps do not exceed, say 5 in., there would be required in the case cited above, a 20-in. belt running at a speed of 350 ft. per min.; or, for 14-in. lumps, a 30-in. belt, running at a speed of 155 ft. per minute.

Cubic feet per hour can be converted into tons per hour, for material of any given density (weight per cubic foot) by entering the chart at the top and following down the vertical line corresponding to the given cubical capacity, to its intersection with the diagonal corresponding to the given density or weight of material. From this point follow the horizontal line to the tonnage scale on the left. By reversing this process the cubic capacity corresponding to any given tonnage and material may be found.

In all cases the lower diagonals for different widths of belts are terminated at the horizontal line marking the maximum desirable speed for the belt.

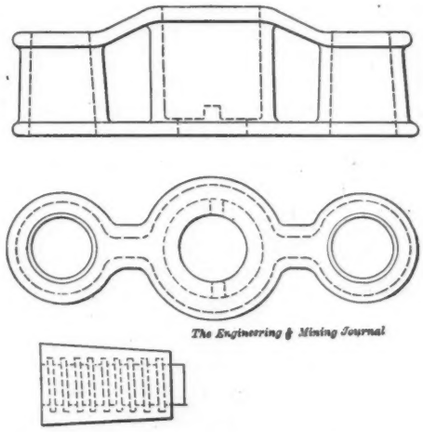
The speed of a belt may be augmented to carry a greater tonnage, the capacity varying in the same ratio as speed, provided the maximum speed is not exceeded.

An electrically heated dryhouse has been built at the Stewart mine in the Cœur D'Alene district, Idaho and is a great improvement over the old fuel- or steam-heated affair. A uniform and constant warmth is maintained without the need of an attendant. The miners are pleased with the innovation.

Jack for Machine Drill Columns

Machine-drill jacks become quite heavy as the length of the column increases, especially when a column with two jack screws is used. In the Michigan copper country, machines have to be set up with columns as long as 13 ft. It therefore becomes important to make them as light as possible, especially now that one-man machines are being introduced. In driving drifts it is often desirable to have two lengths of column; in such a case the Osceola type of machine column, in which the jack proper is in one piece and the post in another that can be lifted out of its socket in the jack part, is quite convenient, as then only an extra post part is required. Moreover, when the post has to be moved, the weight to be lifted is divided in two as the two parts are moved separately.

At the Osceola Consolidated and the Calumet & Hecla mines, the post part



CAST-IRON JACK FOR A DRILL COLUMN

consists of an ordinary 4-in. gas pipe for both two-man and one-man machines, with a light cast-iron cap piece fastened to the upper end. In the bottom of this pipe a notch is cut to fit over the lug in the bottom of the socket hole of the jack part. The accompanying drawing shows the design of this screw part, which is cast in one piece with socket holes, into which the nuts of the jack screws are fastened. The lug on the bottom of the post socket is now cast square, but in the future it is probable that it will be cast with a V-section, so that the notches in the bottom end of the post part can be cut to fit tight, for often at present these notches in the post are cut too wide, allowing the post to turn slightly when the machine is started, throwing the hole slightly out of alignment and making the miner uneasy in regard to his set-up. Such a machine jack can be made cheaply, as there is no machine work on the casting, while its use is a great advantage where a two-post jack is required for one-man drills.

Gravity Plane at Liberty Bell Mine*

BY CHARLES A. CHASE†

Chute troubles, more particularly from the ore hanging on the foot wall, were encountered early at the Liberty Bell mine. With the advance of mining work, a main chute 700 ft. long was used, which, during the driest months of winter, was choked so as to require reopening every three days, in order to permit the movement of ore. Moreover, during the rest of the year, in spite of every reasonable precaution, enough water found its way into this passage to semi-liquify the soft ore. If the ore was allowed to accumulate, the chute broke, frequently burying trains below, and, in one case (fortunately without loss of life) an entire crew of trammers. After transportation to the surface, this water-logged ore broke tramway bins and flooded the station; on the way to the mill it overflowed tramway buckets; and at the mill it burst the battery bins and flooded the batteries. The ore, as it came from the stope, was soft, but reasonably dry; and it was in the main gathering chute that this trouble became acute. The remedy for this condition was found in lowering the ore through the chute in skips.

The success of the first of these gravity planes led to the reconsideration of a plan to connect the new Stilwell tunnel with the upper mine by a vertical raise, in which cars were to be lowered by cage. But this idea was abandoned, and a skip-way on the vein was carefully designed to serve as the main outlet and inlet during the entire life of the mine. The accompanying illustration shows the character of the arrangement. This being essentially a gravity plane, power is necessary only when an empty skip is to be lowered, or an unusually large load is to be hoisted. By reason of the purchase of power on the peak-load basis, a motor of only 25 h.p. is provided, which operates the skip at 100 ft. per min., while on gravity the speed is 500 to 600 ft. The filler or small pocket, just under the level, holds one skipload, 6 tons. The toggle-locked door is opened with a single movement of the lever by the cager on the level. At 100 ft. above the tunnel level the skip drops through a switch and falls into a vertical position, dumping automatically; the door being self-locking thereafter.

Transportation for men and timber is provided by a man cage coupled above the skip—the two carriers making one 6-wheeled unit, and the power being applied at the knuckle between the two ele-

*Excerpt from a paper entitled, "Notes on the Liberty Bell Mine," read October, 1911, at the San Francisco meeting of the American Institute of Mining Engineers.

†Consulting mining engineer, 921 Equitable building, Denver, Colo.

ments. The reason for this construction may not be obvious. As originally planned, on the assumption of uniform dip the carriers were separate units, and power was to be applied at the upper end of the man cage. But sharp changes in dip were encountered, and as the man cage is usually empty, and the skip loaded, the light cage would be lifted heavily against the guide by the pull of the cable. This condition led to the construction adopted, by which the power is applied direct to the heavy load and the light man carrier is independent of the lifting tendency of the 1⅛-in. rope.

The carriers look, and are, light; but they have proved adequate. In operating these gravity planes it has been evident that success lies in having the weight of the equipment constitute the smallest reasonable part of the total weight of ore and equipment. To this end three novel features were introduced:

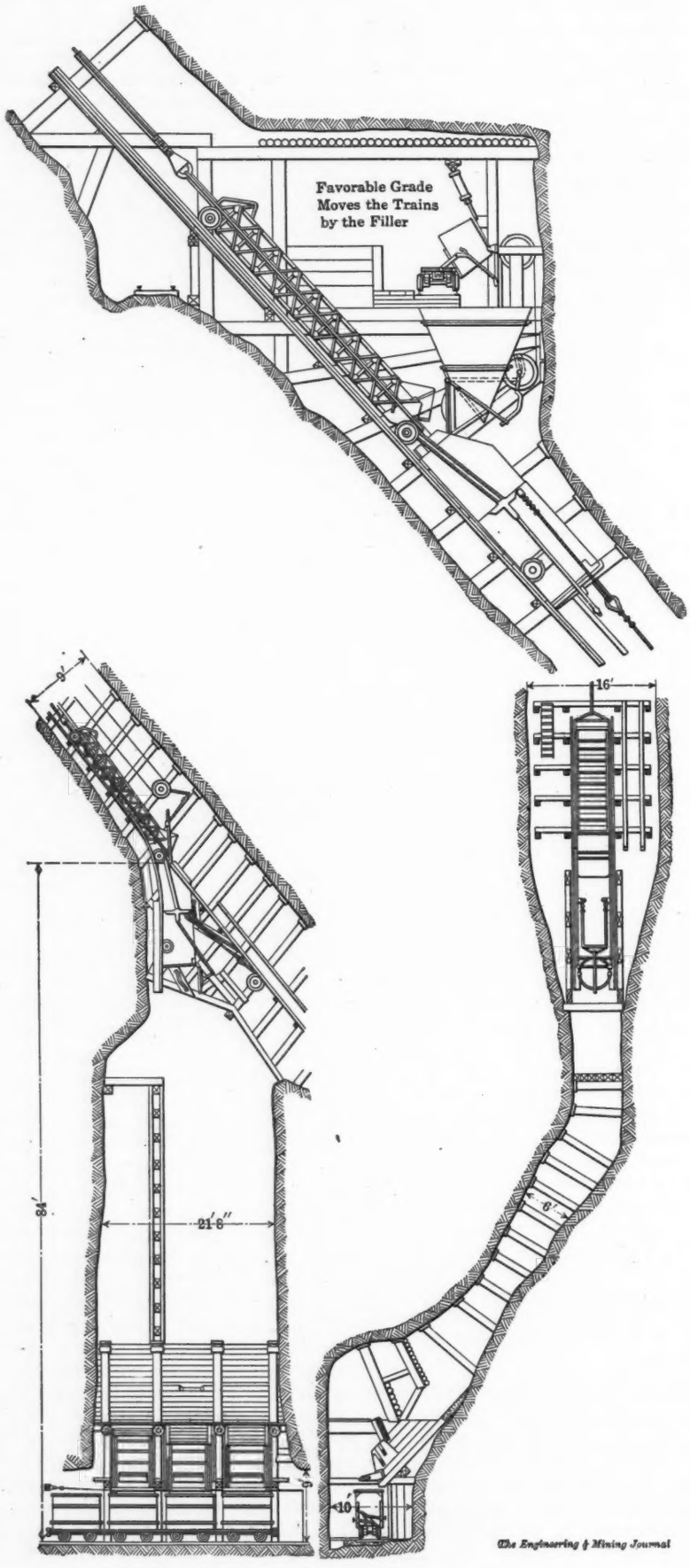
(1) The skeleton man cage, holding 28 men and weighing 2700 lb.; (a rope ladder dropped into the skip holds 12 men).

(2) The rope bail, a 50-ft. section of 1⅛-in. plow-steel cable, spliced endless and passing around curved crossheads at the knuckle and at the attachment to the main cable.

(3) The tubular skip, built of ¼-in. steel plates and having a standard ⅜-in. boiler head for a door.

Of all shapes of skips the tube has the advantage of greatest capacity and strength per unit of weight. The door is remarkably strong. The skip complete, with liner plates in its lower third, weighs 3900 lb., and its capacity is 150 cu.ft.

A 1⅛-in. tail rope passes from the ore skip around a tension sheave in the 50-ft. sump and rises to the counterweight of 15,000 lb., thus affecting complete rope balance at all positions of the carrier. The endless-rope mechanism for braking and driving is placed with its drum in the upper extension of the plane, the rope not being deflected to or from it. The upper drum geared to the motor clutch carries two slip rings, and two half laps of the rope. A lower transfer drum carries a single ring and one half lap. Each of two independent hand-operated brakes act on both drums, providing ample safety. The slip between rope and rings, and between rings and drums, is slight and gradual, and does not prevent the geared indicator from showing the approximate position of the skip. The exact position is shown, however, by red-lead marks on the cable. Idler sheaves, 48 in. diameter, with hard-iron wearing rings babbitted in, support the cable at the changes of dip. Signaling is done by electric bells. Two No. 6 hard-iron wires, 3 in. apart, can be bridged by the cager at any point. The cager is called by telephone. It is not necessary for him to accompany the ore, and he is free to dump cars into the fillers at the station.



SKIP AND MAN CAGE IN LIBERTY BELL INCLINE

Efficiency of Ore Roasting

By Arthur S. Dwight*

The history of roasting is briefly stated and the efficiency of the different processes compared. Blast roasting has largely replaced all other methods.

*Consulting mining engineer, 25 Broad St., New York.

Note—An article published in School of Mines Quart., November, 1911.

This is a study of the relative efficiencies of some of the more important desulphurizing methods used in the metallurgy of lead and copper, to prepare the ore for smelting. It is proposed to show how these efficiency factors have served to shape the development of the roasting process from the crude and inefficient method of burning ore in heaps, through the multifarious forms of reverberatory furnaces, up to the recently devised systems of blast roasting.

Aim of Roasting Varies with Kind of Ore

The exact purpose of the roasting operation is not always the same; thus, in roasting lead ores, it is usually desired to eliminate as much of the sulphur as possible, in order to avoid making, in the smelting operation, an undue quantity of matte, a troublesome byproduct which locks up valuable metals that ought to have been set free in the metallic product, and thus calls for an extra treatment to recover these metals. With copper ores, on the contrary, a matte is the logical product of the first smelting, and hence it is customary to leave a definite remnant of the sulphur to "cover" the copper and prevent unecessary losses of metal in the slag.

Again, on account of the greater fusibility of lead ores, and the ease with which lead may be volatilized and lost, a more careful heat regulation is necessary in their treatment, and this tends not only to lower the efficiency factor of a given type of furnace, but definitely to debar certain types from service with lead ores. However, these variations are no greater than those which may be caused by the varying skill shown in design and operation, and we may, therefore, neglect them for the purposes of the present discussion. It is sufficient to say that the relative efficiency factors here deduced will be approximately true for either lead or copper ores, though special metallurgical requirements may dominate the choice of apparatus.

Roasting Capacities

The roasting capacities of different types of furnaces depend upon the same general principles, viz., (1) the quantity of ore that can, within a given period of time, be effectively exposed to the oxidizing influence of the air, and (2) the rapidity with which the oxidizing action can be effected. Large area of hearth and frequency of stirring are the means generally employed for increasing the quantity of ore thus exposed, while careful control of the heat and air supply, fine crushing and intelligent regulation of the chemical composition of the ore mixture contribute to the speed of oxidation.

Essentials of Efficient Roasting

Dr. E. D. Peters[1] thus summarizes the fundamental requisites for rapid and efficient roasting: "(a) Small ore particles. (b) A vigorous air current, which shall constantly bring fresh oxygen to the surface of the ore, and shall also sweep away the residual nitrogen of the spent air and the sulphur-dioxide gas which which would dilute the atmosphere in contact with the ore so that its oxidizing power would lose its efficiency. (c) Frequent stirring of the ore, for, after the removal (approximately) of the first atom of sulphur from the pyrite—which atom is driven off by heat alone—the oxidation of the ore proceeds with discouraging slowness as soon as the upper layer of sulphide particles has become partially oxidized."

To determine the relative efficiency of different types of furnaces requires us to go a step further than the mere capacity of the furnace, as the question of fuel, labor, repairs, interest charges on the plant and on the value of metals locked up in the process, and finally the character of the product, have an important bearing. Many of these factors are variables, even when considering the same type of furnace under different conditions; hence it is difficult to select one factor which tells the whole story.

Taking everything into consideration, the best factor we have is the number of pounds of ore treated per day on a square foot of the furnace hearth. This factor involves the time element, which must necessarily enter largely into the makeup of most of the other factors, and it also involves the factor of size which gives a certain measure of the size of the furnaces and the buildings required for handling a given tonnage, and this, in turn, is a rough index of the first cost of the plant. As regards the important question of fuel, a "free-burning" ore will, when charged into the hot furnace, take fire and burn without any external fuel being required; and, although certain styles of furnaces are more suitable for propagating and maintaining this reaction than others, the actual efficiency factor will not be materially different, whether all of the necessary heat is supplied by the sulphur in the ore itself or by coal burned on the grate, though the cost of roasting will probably be much higher when the external fuel is used.

Again, the character of the roasted product, its fineness or coarseness, is a matter of great importance. If the blast furnace is to do its best work, it must be given material reasonably coarse and preferably cold. The reverberatory smelting furnace, on the contrary, does best when the charge is made up of hot fines. The smelter of copper has the choice of both types of smelting furnaces, but the smelter of lead is limited to the blast furnace, and hence is likely to be much more solicitous that his roasting operations shall yield him a coarse product. Briquetting the fine roasted ore has helped him to secure this desideratum, but this, in turn, has involved a separate and expensive operation, with results not entirely satisfactory, so that briquetting is adopted only with reluctance. Other things being equal, that furnace which will turn out a product in coarse form is entitled to a long credit mark, and this may surpass in practical importance its efficiency factor.

Four Classes of Roasters

We may divide those roasting methods which are pertinent to this discussion into four principal classes:

(1) Roast heaps and stalls.

(2) Reverberatory roasters: (*A*) Hand stirred furnaces. (Hand reverberatory.) (*B*) Mechanically stirred furnaces of diverse styles. (*C*) Revolving cylinders. (Brückner, etc.)

(3) Blast roasting in pots by the Huntington-Heberlein, Savelsberg, Carmichael-Bradford and McMurtry-Rogers methods.

(4) Blast roasting of thin layers (Dwight-Lloyd system). (*A*) Intermittent down-draft pans. (*B*) Continuous-sintering machines.

It is not intended to describe in detail the different methods and furnaces here referred to, but merely to indicate those points which relate to this discussion, as well as those which are necessary to show the basis for calculating the efficiency factor.

The roast heap is the most primitive form of roasting appliance, requiring practically no plant but the area of ground upon which the coarsely broken ore is piled on a layer

[1]"Some Future Problems in the Metallurgy of Copper." "The Mineral Industry," Vol. XVII, 1909, p. 282.

of cordwood to kindle it, and covered with a layer of finer ore to control the degree and direction of the draft. Some of the irregularities of heap roasting may be prevented by conducting the operation in masonry stalls with paved floors containing air ducts, and sometimes a system of flues connected with a chimney to assist the draft and dispose of the noxious sulphur gases, but the principles involved and the efficiency factors are about the same.

Essentials of Heap Roasting

The bulk of the ore in the pile must be coarse, to permit the free passage of gases. From the very nature of the operation, no rabbling or stirring is possible during the roasting, for which reason the results are at best extremely irregular. When a finished heap is discharged, streaks of imperfectly roasted material will be found which must be sorted out and subjected to a second fire and sometimes even a third. This sorting and re-treatment may be considered as an archaic form of stirring or rabbling. Sometimes the same result is obtained more efficiently by successively stripping off the outside of the heap where the ore naturally roasts more quickly and effectively than in the interior. By thus scraping off the outer layers as fast as they are finished, the inner portions are successively given this same advantage until the entire pile is consumed.

Cheap and plentiful labor, though not necessarily skilled, is an essential when so much handling and rehandling is called for, but granted this, the cost of roasting a ton of ore in heaps may be as low as by the most modern and approved methods, in spite of its low efficiency factor. The physical character of the product is generally favorable for the blast furnace, being coarse and spongy. Heap roasting is frequently found to be an effective aid in getting a new metallurgical enterprise started quickly, on account of the absence of complicated plant, but is seldom used as a permanent method, at least under competitive conditions, because labor is usually not sufficiently cheap and plentiful. Losses by wind and by the leaching of soluble metallic salts by rain may be serious, particularly with copper ores. The great objection to heap roasting, however, is that it is so slow that the interest charge on the capital locked up in the ore undergoing treatment becomes a serious item of expense. In other words, its efficiency factor is low. For this discussion, we may take the efficiency factor at 5 to 20 lb. per sq.ft. of hearth area.

To illustrate this most primitive method, we may select the practice of heap roasting at Goslar, Lower Harz, Germany.[2] The heaps are 35 to 40 ft. square at bottom and 12 ft. square at top, with a thickness of about 6 ft., resting on a layer of cordwood and faggots 16 to 20 in. thick, the whole being heavily blanketed with a thick layer of fines. The contents is about 400 tons. First roasting lasts six to seven months, after which the unroasted portion is sorted out and subjected to a second and even third fire of shorter duration. The "hearth area" is regarded as equivalent to the area of the average horizontal section of the pile, here taken at 872 sq.ft. Conceding that with favorable conditions and skillful manipulation the entire contents of the pile might be satisfactorily roasted in the first period of six months duration, the efficiency factor will be:

$$E = \frac{800{,}000\ lb.}{872\ sq.ft. \times 180\ days} = 5.1\ lb.\ per\ day\ per\ sq.ft.\ of\ hearth$$

There are examples of more efficient heap roasting than this, for the Gosler practice prolongs the roasting period to what seems an unnecessary degree. The explanation is probably found in the fact that the recovery of part of the sublimed sulphur was attempted. This result would be promoted by heavy blanketing of the exterior by means of the layer of fines and this would naturally make the roasting slow.

In commencing our series of efficiency factors with the heap roast at 5 lb. per sq.ft. per day, we do so with the further explanation that in other localities heap roasting has been brought up to a relatively high degree of perfection, so that the efficiency factor may easily run as high as 20 lb. per sq.ft. per day, and cases are on record where it has approached closely to the efficiency factor of the hand roasters, next to be described.

Reverberatory Roasters

The prototype of all the furnaces of this class is the German long-hearth reverberatory furnace, the so called *Fortschaufelungsofen*. This has a long rectangular hearth covered by a low, flat, reverberatory arch, with a firebox at one end and an exit flue at the other, and numerous working doors on both sides to admit the long handled tools for stirring or rabbling. The ore is fed to the furnace near the exit flue, spread out in a thin layer on the hearth, frequently stirred to expose new surfaces for oxidation, and gradually moved by the rakes and paddles toward the fire bridge when it is exposed to the highest desirable heat just before being discharged. The labor of rabbling is severe in the extreme, and it was natural that efforts should have been made to relieve the workmen and accomplish the stirring by mechanical means. This gave rise to a great variety of mechanical roasting furnaces, of all shapes and sizes, and employing widely different mechanical devices for moving and stirring the ore, but the principle underlying all of the furnaces of this general type, both hand and mechanically operated, is the same.

From this point of view it will be interesting to observe how the efficiency factors of these highly developed forms of automatic roasting furnaces compare with one another, and with their own prototype, the hand roaster.

Hand Reverberatory Costly but Reliable

The general features of the hand-stirred reverberatory furnace have been already described. The earlier furnaces were smaller than those of later construction, but a length of 65 ft. and a width of 15 ft. were found to be the practical limits of hearth area, and few improvements have been made in this furnace during the last 20 years. By reason of the greater flexibility of hand rabbling, this furnace has been found peculiarly suited to roasting lead ores, and in spite of all the efforts that have been made, in the interest of economy of labor, to adapt the many automatic furnaces to this service, the hand roaster has remained, almost to this day, the one trusted and reliable roaster for the lead metallurgist, that is able to meet any situation that may rise. It is costly to operate, both as to fuel and labor, and occupies an enormous area in proportion to its output (i.e., its roasting efficiency is low) but it is reliable. Another reason for its long popularity is the favorable character of its product. By care in making up the charges, and skill in regulating the heat at the finish, the particles of roasted material can be discharged in a sort of nodulized condition which is considered reasonably favorable for the blast furnaces.

One modification of this furnace which was extensively used in the West for some years was the slagging roaster, which was originally used at the Omaha & Grant smeltery, Denver, Colo. This consisted of a combination of a reverberatory melting hearth next to the fire bridge, and a long flat hearth in which the preliminary roasting was effected by the waste gases from the fusing box. The ore, during roasting, was gradually moved toward the fusing box, and finally scraped in and melted in batches, forming a slag which was drawn into pots, and, when cold, was sent to the blast furnace. This product was highly appreciated for its coarse mechanical condition, but the practice was finally abandoned on account of high metal losses. It was an interesting development, however, as an illustration of the price the lead metallurgist was willing to pay for a coarse smelting material.

The capacity of a typical hand roaster with a hearth $60 \times 15 = 900$ sq.ft. was about 12 tons per 24 hours or 26.6 lb. per sq.ft. per day. Collins[3] gives the fol-

[2] Collins, "Metallurgy of Lead," second edition, 1910, p. 70.

[3] "Metallurgy of Lead," p. 85.

lowing comparative factors of efficiency, in pounds per square foot per day: Przibram, Bohemia, 31; Laurium, Greece, 28; Port Adelaide, Australia, 12; Cockle Creek, Australia, 29; Colorado Smelting Co., Pueblo, Colo. (Eilers plant), 37; St. Joseph Lead Co., Bonne Terre, Mo., 30; No. 3, Monterey, Mexico, 24; Murray plant, Utah, 24. We may, therefore, take the efficiency factors for hand roasters as between 24 and 35 lb. per sq.ft. per day.

Mechanical Reverberatories

The development of the automatic roaster from the hand reverberatory has been already referred to. The line of improvement follows almost exclusively the one idea of more frequent stirring of the ore. Again to quote Doctor Peters,[4] "What I wish to point out in this immediate connection is that this question of a more frequent stirring of the ore was the one glaring fault in our roasting practice of 30 years ago, and, that, really, almost the entire energy and ingenuity of the inventors and users of automatic furnaces were focused upon this single point. All the wealth of science and of modern mechanical skill has been brought to bear upon the exposing of fresh particles of ore to heat and oxygen as frequently as is needful, and has been successful."

Mechanically stirred furnaces had been used many years ago in England, principally for roasting tin ores, but apparently at that time they did not fit into the requirements of the copper and lead business, or, if so, it was to an exceedingly limited extent. The Parkes, original MacDougall and Brunton furnaces were invented at that time, and have served as the prototypes of some of the most successful of the modern automatic furnaces. The O'Harra was developed in the early days of Butte, Mont., and became the prototype of another series of adaptations. In fact, there was a voluminous crop of patent furnaces, and almost every metallurgist of renown had one of his own. The rivalry was intense, and furnished an interesting and probably a necessary chapter in the history of American metallurgical practice. Some of these furnaces had commendable features, but the chief praise that could be given to most of them was that they were "different." Of the many that once bewildered the metallurgist, a few that had the requisite combination of merits have survived. These merits are simplicity, durability and low repairs, low first cost and satisfactory efficiency. A glance at the table of relative efficiencies of these automatic furnaces will show that there was an exceedingly small range of variation among the different styles, considering the extent of the effort that was made for improvement. The following table gives representative figures of efficiencies (pounds per square foot per day) for furnaces of different styles operating under widely different conditions, in both lead and copper work.

EFFICIENCY FACTORS OF VARIOUS STYLES OF MECHANICAL ROASTERS

	Collins[5]	Kern[6]
Brown-Allen-O'Harra	34	74
O'Harra, Butte, Mont.	...	33-36
Brown horseshoe	48	35–38
Brown horseshoe (treating matte)	38	
Pearce turret (treating matte)	43–55	60–66
Ropp straight-line, Port Pirie, Australia	95	
Ropp straight-line, Hanauer, Utah	33	
Ropp straight-line, general conditions	60	67–77
Keller-Cole-Gaylord, Germania, Utah	104	44–48
Heberlein, light roast	150	
Heberlein, Sulivan, B.C.	169 (?)	
Godfrey, Murray, Utah	54–80	
Godfrey, Australia	141	
Wethey, original		60–65
Wethey, improved		65–70
McDougall, Evans-Klepetko, Anaconda, Mont.		84–86
Edwards		140–152
Herreshoff-McDougall		30–35

It is evident, therefore, that we may safely claim for furnaces of this class an efficiency varying from 33 to 75 lb. per sq.ft. per day for ordinary conditions, and as high as 150 lb. per sq.ft. per day when but little sulphur elimination is required. This latter figure may properly be used in making comparisons with the blast-roasting process.

Revolving Cylinders Abandoned

Revolving-cylinder roasters, as exemplified by the Brückner cylinders, were popular at one time, both in lead and copper work, but are now almost entirely abandoned. The high proportion of flue dust made by the Brückners was one of the principal causes of the gradual abandonment of this method of roasting. It is to be regarded essentially as a revolving reverberatory furnace, in which the inner lining of the cylinder becomes successively the hearth and the reverberatory arch of the furnace, and the exposure of fresh surfaces of ore is accomplished by the changing talus of the material as the cylinder slowly revolves. The area of the hearth may be taken for practical purposes as equivalent to the horizontal projection of the cylinder.

At the Germania plant, in Utah, the Brückner practice attained its highest perfection. Here the cylinders were 22 ft. long by 8½ ft. diameter, and treated 12 tons per day. Equivalent area of hearth was 187 sq.ft., making the efficiency factor 128 lb. per sq.ft. per day.

To summarize the characteristics of the automatic roasters of the reverberatory type, we may say that they show a distinct gain in efficiency over the hand stirred type, though the gain is not so marked as one would expect. The truth is that a practical limit is soon reached as to the amount of sulphur that can be burned on a square foot of hearth area in a given time without causing the sulphides to melt and interfere with the further progress of the reaction, or clog the stirring mechanism. This practical limit probably corresponds closely to the efficiency factor of 75 lb. per sq.ft. per day, though in certain special cases where the ore contains less sulphur, or from its nature will bear a higher temperature without fusing, or where there are special provisions for moderating the resulting temperatures (as in some of the improved types of MacDougal furnace, notably the Wedge furnace), the efficiency factors may be carried as high as 175 lb. per sq.ft. per day.

Blast Roasting in Pots

The last paragraph called attention to the great stumbling-block in the way of increasing the efficiency of the mechanically stirred reverberatory, arising from the too rapid generation of heat by the mass action, whereby the sulphide is caused to melt or "matte." The next important advance in the art of roasting resulted from discovering how to control and check this mass action. It was accomplished by mixing the grains of sulphide to be roasted with grains of an inert or refractory material in such proportion that the particles of sulphide are held apart from one another by refractory grains. If a mass of material so constituted be ignited at one surface and a blast of air forced through it, the sulphide particles will successively shrivel up in the fierce oxidizing blast, and the reaction will propagate itself through the mass in the direction of the air current. An additional advantage may be secured if the isolating grains are of such composition that, while they remain inert during the roasting period, they will, at the temperature developed by the cumulative mass action, combine with the newly formed metallic oxides to form a reasonably fusible slag or sinter.

This is the action, as we now understand it, but at first the reason for the extraordinary rapidity of the roasting was not so evident. Instead of recognizing it as a purely mechanical effect, Messrs. Huntington and Heberlein, who first developed this process, were misled into the belief that some powerful chemical reagent was at work, and that the burnt lime they employed as an isolating ingredient of the charge was the vehicle for nascent oxygen in the form of CaO_2. So sure were they of this fact that they based their patents in all the important countries of the world upon this reaction, and the theory was generally accepted as true until research demonstrated that it was untenable. Even then it was generally held that the lime had some important, though mysterious, chemical effect, and the process was still called

[4]Peters, "The Mineral Industry," Vol. XVII, 1909, p. 283.

[5]Collins, Op. Cit., page 90.

[6]E. F. Kern (by permission) Lecture Notes, 1910 (unpublished).

"Lime Roasting." It has now been demonstrated that many other substances will answer as well, if not better, than lime, and "blast roasting" is now generally accepted as the more logical and precise designation.

Although Messrs. Huntington and Heberlein did not realize at first the true cause of their success, they are none the less entitled to great credit for working out a successful process which constituted a great step in advance, and removed some of the most perplexing difficulties of the lead metallurgist. They made it possible to roast fusible galena ores cheaply, efficiently and with diminished metal losses, yielding a product of remarkably favorable physical character, which greatly promoted the efficiency of the subsequent smelting. Although the form of apparatus they employed (blast pots) was crude and primitive, the efficiency factor was far higher than had even been previously attained by what Dr. Peters has referred to as the "wealth of science and modern mechanical skill," as applied to the roasting problem.

The procedure originally proposed by Huntington and Heberlein required a preroasting of the charge before treatment in the pots, but as experience was gained in manipulation it was found possible, under some conditions, to dispense with the preroast and subject the charge to direct converting. The variations in the process devised by Carmichael and Bradford in Australia, and by Savelsberg in Germany, dispensed with preroasting. The first named investigators noticed that sulphate of lime was quickly formed in the converter, and reasoned that it might as well be introduced at the start in place of the burnt lime. Savelsberg carried this reasoning still further, and substituted crushed limestone. Patents were granted to all of these investigators, and their processes have found extensive utilization. But the efficacy of the lime was unquestionably overestimated, and its true function misunderstood.

Huntington-Heberlein Apparatus

The original Huntington-Heberlein pot was small and deep. As the roasting and sintering action propagates itself progressively upward, the time needed to complete a charge depends more upon the distance which this slowly moving zone has to travel than upon the actual weight of material treated. I have shown in a previous article[7] that, on account of this progressive sintering, most of the space in a converter is utilized for storing rather than for treating its contents. It was to be expected, therefore, that the improved forms of pots developed by later experience should be larger and shallower. As the depth was diminished, however, the proportion of unsintered fines tended to increase, and this tendency limited the improvement in that direction.

The reason for this is found in the fact that the gases escaping at the top of the pot keep the loose particles on the top surface in constant agitation and thus prevent the close brooding contact which is necessary to secure complete sintering. With a modern 10-ton pot, 9 ft. diameter by 4 ft. deep, the proportion of fines will usually amount to about 10 per cent., sometimes as high as 25 per cent.

The pot discharges its product in the form of a huge cake of sintered material, which requires considerable hand labor to break into suitable size for smelting, even after a preliminary shattering of the cake has been accomplished by dropping it from a height. On account of its coarseness and its more or less cellular structure, the pot product is highly prized as material for the blast furnace.

The initial sulphur in a properly proportioned blast-roasting charge should not be higher than about 18 per cent. if the most efficient results are to be obtained, and this fact should be kept in mind in comparing the efficiency factors with those of the older types of roasters. As already stated, the most favorable efficiency factor of the automatic reverberatory roasters (175 lb. per sq.ft. per day) may properly be used in making comparisons with blast-roasting results. The grate in the bottom of the pot, through which the air enters the charge, is much smaller than the diameter of the pot, and as there is a complete diffusion of the air through the charge it seems only proper in calculating the equivalent hearth area of a pot, to use the area of the average horizontal section, just as was done in the case of the roast heaps, previously discussed.

The published figures of costs and capacities of the early Huntington-Heberlein work show some serious discrepancies, and are usually much more favorable than the known work of present-day plants using the same process and presumably improved practice. The following cases have been selected as fairly showing the range of capacities:

Huntington-Heberlein[8]—Converters hemispherical 9 ft. diameter by 4 ft. deep, holding 8 tons material. Grate 6 ft. diameter, but assume equivalent hearth area (7½ ft. diameter), 44 sq.ft. Time of blowing, 12 to 18 hours. Allow 1½ turns per day. Hence, capacity is 12 tons per day per converter, and efficiency factor is 545 lb. per sq.ft. hearth area per day.

Huntington-Heberlein, Trail, B. C.[9]—Converters, 8 ft. 8 in. diameter by 4 ft. deep, hold 12 tons. Equivalent hearth area, 44 sq.ft. Capacity, 15 tons per day per converter. Efficiency factor, 680 lb. per sq.ft. per day.

Savelsberg[10]—Pots, 8 ft. diameter, contain 8 tons; equivalent hearth area, 38.5 sq.ft. Time of blowing, 18 to 20 hours, say 1¼ turns per day, or 10 tons per day per converter. Efficiency factor is 520 lb. per sq.ft. per day.

McMurty-Rogers[11]—Pots, 8 ft. 8 in. diameter by 4½ ft. deep, take 8-ton charge. Equivalent hearth area, 44 sq.ft. Time of blowing, 12 hours. Assume 1¾ turns per day; capacity is 14 tons per day per converter. Efficiency factor is 636 lb. per sq.ft. hearth per day.

Roasting boxes, Bingham Junction, Utah[9]—Hearth area, 36 sq.ft. Capacity, 16 tons per day. Efficiency factor, 890 lb. per sq.ft. per day. (Considerable percentage of fines requiring retreatment.)

From the above figures we draw the conclusion that the average efficiency factors for pot roasting lie between 500 and 900 lb. per sq.ft. per day, with average probably close to 600 lb. This is indeed a remarkable gain in efficiency over the best work of the reverberatory furnace under equivalent conditions of sulphur elimination, and fully justifies the verdict pronounced by Prof. Joseph W. Richards in 1908[12] that pot roasting was "the most radical improvement in recent years in the metallurgy of lead."

Blast Roasting of Thin Layers

Attention has here been called to two of the weak points of the pot-roasting procedure caused by the use of the thick layer, viz.: The ineffective utilization of the space in the converter, and the massiveness of the cake produced. Very early in my efforts to devise a means for adapting the blast-roasting idea to the treatment of copper fines I came to realize the economic importance of finding a means for completely sintering a thin layer, in order to eliminate these two objectionable features. When a thin layer, say 4 in. thick, was treated on an ordinary grate with up-draft, the bottom 2 in. would be sintered and the upper 2 in. would remain pulverulent. This was the net result of the efforts of many who experimented in this line.

Finally it was found that by applying a mechanical means for holding quiescent the particles which had usually remained unsintered and maintaining them in close contact with one another, a complete agglomeration could be effected. It was found that this could be accomplished by restraining screens with up-draft or side-draft, but the simplest way was to constitute the supporting grate the restraining screen by reversing the usual direction of the air blast and passing the air downward. This completely solved the problem. It had the beneficial effect also

[7]Eng. and Min. Journ., Mar. 28, 1908.

[8]Ingalls, "Lime Roasting of Galena," Trans. A. I. M. E., Vol. XXXVII, 1906.

[9]Hofman, "Recent Progress in Blast Roasting," Trans. A. I. M. E., Vol. XLI, 1910.

[10]Ingalls, "The Savelsberg Process," Eng. and Min. Journ., Dec. 9, 1905.

[11]"The Mineral Industry," XVI, 1908, p. 334.

[12]"Metallurgical Calculations," Vol. III, page 560.

of automatically preventing channeling and the formation of blow-holes. The resulting gain in efficiency was remarkable.

When the principle was applied to shallow down-draft pans operating intermittently, the results were much superior to the best work of the pots, the product was more porous and easily broken to the desired size, and, on account of the lesser mass action and greater heat radiation of the thinner layer, a wider range of chemical composition was permissible. Further study along these lines pointed out the way to making it a continuous process, and this has still further increased the efficiency factor, so that the final result achieved shows almost as great an improvement over the pots as these had previously shown over the best automatic reverberatories.

Intermittent Dwight-Lloyd Pans

The intermittent procedure has been tried generally in an experimental way or as a preliminary to the adoption of the continuous process, by which the former has almost invariably been superseded. Accounts have been published of two sintering plants that were designed to treat thin layers intermittently, following the procedure described in the fundamental patent of Dwight and Lloyd.

One of these plants was that built at Cerro de Pasco, Peru, in 1907, under an arrangement with the owners of the Dwight-Lloyd patents, but following independent designs. The description[13] is incomplete and the figures not entirely consistent, which is probably explained by their being taken from a Peruvian government report. The installation appears to have been not very satisfactory, and did not operate long. The reasons are sufficiently clear.

The other plant[14] was built at Port Pirie, Australia, by the Broken Hill Proprietary Co., to be used in connection with the Carmichael-Bradford gypsum process. It has since been superseded by the Dwight-Lloyd continuous process without gypsum. Its efficiency factor was about 1800 lb. per sq.ft. per day.

[13]Min. and Sci. Press, Jan. 30, 1909.

[14]Collins, "Metallurgy of Lead," 1910.

The principal reason why the efficiency factor of the intermittent apparatus is lower than that of the continuous is because of the time lost in the former by the operations of charging, igniting and discharging, and the difficulty of knowing just how the process is progressing and when it is finished. This loss of efficiency has been found to be 30 to 50 per cent. Under reasonably favorable conditions I have found the efficiency factor of the down-draft intermittent method to be 1000 to 2000 lb. per sq.ft. of hearth per day.

Continuous Process

No attempt will here be made to describe the details of this method, but the reader is referred to some of the several published descriptions.[15] It is sufficient to say that in the method now generally used a thin layer of the ore is fed on a continuously moving conveyor, with grated bottom, traveling over an air-tight box connected with an exhaust fan, which causes air currents to be drawn down through the layer of ore and the grate upon which it rests. Immediately after the stream of ore emerges from the feed hopper its level top surface is ignited by momentarily passing under an igniting device. Thenceforward the heat necessary for the propagation of the roasting and sintering reaction is derived from the internal combustion of the sulphur or other combustible ingredients of the charge.

The speed of travel is so regulated that when a given portion of ore has traveled across the suction box to the point of discharge, the zone of sintering action has progressed down to the grates, and the operation is complete. The fact that all the adjustments are reduced to mechanical terms makes it possible to keep the closest watch on each condition independently and quickly to correct any departure from normal.

The hearth area for purposes of calculation is the horizontal area of the layer undergoing treatment, which is the same as the top area of the suction box. Assuming average figures for specific gravity of ores and for sulphur contents, a standard Dwight-Lloyd sintering unit (type E, 42x264 in.), with an effective grate area of 77 sq.ft., will easily treat 85 tons per day of average suitable material without a preroast, which is equivalent to an efficiency factor of 2200 lb. per sq.ft. hearth area per day, while with a charge corresponding to those with which the best results are obtained in the pots, the capacity runs as high as 120 tons per day, equivalent to an efficiency factor of 3000 lb. per sq.ft. per day.

[15]See, A. S. Dwight, Eng. and Min. Journ., Mar. 28, 1908; "The Mineral Industry," Vol. XVI, p. 381; H. O. Hofman, "Recent Progress in Blast Roasting," Trans. A. I. M. E., Vol. XLI, 1910, p. 739; F. M. Smith, Journ. Assoc. of Eng. Soc., Vol. XLV, July, 1910; Jas. Gayley, Bull. A. I. M. E., August, 1911.

RESUME OF EFFICIENCY FACTORS

	Efficiency Factor, Pounds Ore Treated per Day per Sq.Ft. Hearth	Character of Product for Blast-furnace Smelting
I. Roast heaps and stalls	5 to 20	Good
II. Reverberatory roasters:		
(1) Hand roaster	24 to 35	Fair
(2) Mechanically stirred:		
average conditions	33 to 75	Too fine
special conditions	150	Too fine
(3) Revolving cylinders	128	Too fine
III. Blast roasting in pots	500 to 900	Excellent
average	600	Excellent
IV. Blast roasting of thin layers (Dwight-Lloyd system):		
(1) Intermittent down-draft pans	1000 to 2000	Excellent
(2) Continuous-sintering machines	2200 to 3000	Ideal

Bituminous Coal Mining Costs

At the Chicago meeting of the American Mining Congress, B. F. Bush gave the following as the averages of answers to questions he had submitted to the leading bituminous-coal operators of this country:

1. Capital invested in business. For each ton of coal sold $1.41 is invested in land, machinery and equipment.

2. Average total cost of production, labor cost (mine workmen only), administration and average selling price at mine. Total cost in 1910 averaged $1.07, including 95c. for labor and supplies. Administration cost 12c. per ton, including office and sales expenses, insurance, taxes, legal advice, etc., but not including depreciation, interest nor profit. Average selling price at mine, $1.11 per ton.

3. Estimate of increased cost necessary to meet demand for conservation. Two to 15c. in different fields, averaging perhaps 5 cents.

4. Depreciation per 100 tons daily capacity. About 4c. per ton covers the average depreciation of coal reserves and plant.

5. At what price must coal sell? The increased prices necessary for a fair return on the money invested range from 5 to 25c., averaging 12 cents.

Over-production, over-capacity and ruinous competition were discussed at length. Two possible remedies were suggested:

District sales agencies to control prices and output, under subjection to an interstate coal commission; government assistance in encouraging foreign markets.

The stone production of the United States in 1910 was valued at $36,970,777, the largest in the history of the industry, according to Ernest F. Burchard, of the U. S. Geological Survey. Pennsylvania was the greatest stone producer; New York, second; Vermont, third; Ohio, fourth. For road making, 18,085,170 tons were produced; for use in concrete, 13,967,940 tons.

Experiments in Deflocculation

In an address to the London Society of Chemical Industry, Edward G. Acheson described some experiments that he had made which may be of interest to metallurgists, inasmuch as they give some new light on the physical condition of colloid matter and slime that settles slowly or with extreme difficulty.

In the summer of 1901, while working out the problems involved in the manufacture of graphite from coal and other carbonaceous materials, Dr. Acheson undertook to introduce this artificially made graphite into the crucible trade. The first attempt met with failure, and in investigating whether it was graphite or clay that caused the trouble. it was ascertained that the manufacturers of graphite crucibles in the United States invariably used clays imported from Europe as a binding agent. Samples of these imported clays were found to be far superior to American clays in plasticity and tensile strength, but chemical analysis failed to disclose the cause of the existing physical difference.

Edward G. Acheson found that the addition of certain organic matter to clay and graphite in a finely powdered condition causes them to assume the colloidal state so that they remain in suspension in water for years. The addition of an electrolyte causes settling.

Increasing the Plasticity of Clay

In most textbooks on clays it is generally stated that residual clays are nonplastic, and that sedimentary clays are more or less plastic. Evidently plasticity was developed by or during the transportation from the point of formation to the final resting place of the clay. It would not seem that there was anything in the simple act of suspension in water that would produce the difference in these two classes of clay, and, therefore, some foreign matter carried by the water was looked for as a cause. It seemed most likely that such agents must be organic substances washed from the forests into the running waters. With this idea in view a few experiments were made, using those substances most likely to be found in the washings of vegetation. One of the early experiments consisted in treating kaolin with a solution of tannin. It was noticed that less water was needed to produce a given degree of fluidity, that the tensile strength was increased 244% and that the plasticity was increased by the addition of organic matter.

In the literature of clays no references are made to the addition of organic matter to clay except in one instance, that of the Egyptians in brickmaking, as recorded in the fifth chapter of Exodus. The Egyptians used straw fiber in making bricks. Straw contains no tannin, but when it is boiled with water a reddish-brown liquid is secured, which when mixed with clay gives results fully equal to those produced by tannin. Mr. Acheson now believes that the Egyptians were familiar with the effects he had discovered, and believes this was why they used straw in making brick and were successful in substituting stubble for straw, so he calls clay so treated "Egyptianized clay."

Experiments in Deflocculating Clay

The effect of organic matter as typified by tannin is readily demonstrated. A small quantity of powdered kaolin if shaken with water in a test tube will settle, whereas another portion of kaolin if put in a beaker, moistened with a water solution of tannin to which a small amount of ammonia has been added, and a thorough mixture is made by stirring with a glass rod to eliminate any grinding action as far as possible, and more water is added, the kaolin will not settle. If such a mixture be made with the addition of a little table salt, the kaolin will settle as it did when mixed with water only.

Similar Effects Produced on Graphite

In the summer of 1906 Dr. Acheson succeeded in making artificially a high-grade graphite which he wished to make applicable to all kinds of lubrication. To meet the various demands it would be necessary to have it remain diffused in liquid lighter than itself; for instance, water or petroleum oil. Recalling the effect of tannin on clay, which caused it to remain diffused in water, he treated a sample of his graphite with tannin and found the same effect occurred. A sample of artifically made graphite which had been disintegrated to a fineness, such that it would all pass a 200-mesh sieve, was introduced into a test tube, water added, and after shaking was set aside; the graphite settled to the bottom. Another sample was placed in a beaker and moistened with a solution of organic matter, and after being thoroughly stirred with a glass rod, water was added and the contents of the beaker divided between two test tubes, in one of which a little table salt was added. The graphite settled in the tube containing salt, but did not settle in the other.

The actual amount of deflocculating effect produced on the graphite in the beaker was very small indeed. In commercial work considerable mastication and time are required. If water containing 0.02 or 0.03% of its weight in deflocculated graphite, the deflocculation having been produced by a treatment similar to that applied to the graphite in the beaker, and a little of it be poured on a filter, it will be found that the black liquid runs through the filter paper. The paper retains none of the graphite on its upper surface; all of it passes into and through the paper. If two or three drops of acid be added to the black liquid, and after warming over a spirit lamp it be thrown on another paper, it will be found that a clear colorless liquid passes through the filter. This is the water in which the graphite in a deflocculated condition was diffused; the graphite having been flocculated by the acid, is now retained on the upper surface of the filter paper. This effect can be produced with acid, with a solution of salt, limewater, or any one of that large list of substances known as electrolytes; even so weak an acid as carbonic acid, if caused to bubble up through water carrying deflocculated graphite, will cause flocculation and sedimentation.

Deflocculated Graphite Is in the Colloidal State

Upon being deflocculated, the graphite is diffused through the water in a colloidal state, and samples of deflocculated graphite in water have stood for more than two years without showing any settling, notwithstanding the graphite is 2.2 times heavier than water. It has been found possible to obtain this same effect on natural graphite, amorphous alumina and silica, lampblack and siloxicon, which is an amorphous body, having the formula Si_2C_2O. The effect can be produced with a long list of organic bodies; for instance, tannin or organic substances containing tannin, also with solutions containing the gum of the peach and cherry tree or extracts from straw and grass. The offal from the barnyard proves to be efficient. These organic substances are spoken of as agents when used to produce deflocculation, and they act as protective colloids to the deflocculated body.

From the experiments made with clay and graphite it appears that apparently a great affinity existed between the organic and the inorganic substances introduced into the water. The inorganic body abstracted the organic body from the water, and in doing so was deflocculated. Each particle as it was thrown off was enveloped in an aqueous jelly of the organic agent, or at least such was the working hypothesis followed.

Principles of Mine Management

By Charles A. Chase*

A discussion of the essentials of efficient management, and the means by which a mining community can aid in building up its chief industry.

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Note — Address delivered at Idaho Springs, Colo., Oct. 14, 1911; one of a series of "Practical Talks" given at various mining centers under the auspices of the Colorado Scientific Society.

This paper deals with the relations between the mining community and its principal industry, as well as with the duties of the manager. We all know that the key to successful mine management is a bonanza and yet with that knowledge it seems that we have to search deeper for the root of some of our troubles. This subject looks large, embracing finance, organization and operation, each with its several branches.

Purpose to Study Mining Industry

The object of the movement, of which this paper is an expression, is to look frankly at our industry and see whether we can discover its fundamental weaknesses and correct them. Business in general lags and, even so, the financial end of this industry does not keep step. By this expression, "the financial end," I mean our external financial relation with the great body of business, the source of capital for development and equipment, as distinguished from our internal economics. I assume that our chief trouble is internal, concerned with organization and technique, and shall devote myself to the phases of management connected therewith, for it seems obvious that the weakness internally has much to do with the distrust which results in withholding capital. I wish, however, to expressly disassociate my discussion from the narrow idea of the duties connected with the position of manager.

Mine management begins with location and we are all involved therein, be we locator, surveyor, superintendent, manager, director, owner or citizen in the mining community. The end is profit to ourselves as individuals, to the industry and to the state. Definite duties fall properly upon the regularly appointed manager, but it is imperative that all the classes enumerated, particularly the business and professional men of our mining communities, understand the burdens they must assume, if the industry is to thrive. Perhaps I may distinguish between the management of mines and the management of the industry, and state that, in the first case, the major burden is with the property manager and in the second case it is largely shared with the local business community. To the broader view of the subject I will address myself largely.

Problem of the Small Mine

I wish to deal with broad principles of general application. In a state where most of the individual mining enterprises employ less than 25 men and the individual output is correspondingly small, it is idle to discuss management as it is discussed at Johannesburg, Butte or Bingham. At such places the mines have grown so strong that they are largely independent of the coöperation of their several communities and a discussion of management there is of the technical features of organization, equipment or metallurgy; and, I may say, theirs seems a simpler subject matter than ours.

They have a problem which makes a steady evolution, each year's work, carefully analyzed and compiled, making a secure foundation for the years to come. To us the production of a tithe of the tonnage means the operation of many more properties, each with technical problems as difficult, but without the complete records and the equally available financial resources to supplement our natural resources. We have more problems per ton. The total difficulties are greater and the individual reward is less. On the other hand, the community of small mines offers more positions of responsibility and therein lies one of its rewards.

It is not for us to put aside the work of the large mine as having no lesson for us, for we can with great profit study its directness of attack, rigid avoidance of waste and careful adaptation of means to ends.

The successful mining community is our watchword. Some prospects grow into small mines and cannot become more; others have to be operated on a large scale to be at all successful. The successful nourishment of growth in the early stages calls for the highest skill and the broadest experience. It is appropriate to paraphrase a truism into these words: Take care of the prospects and small mines and the large mines will care for themselves.

Hindrances to Mining Development

There are some difficulties which I wish to point out, certain remedies which I wish to suggest, believing that they are worthy of your consideration: First and, unfortunately, not subject to fundamental correction is the mining law, which permits the granting of patent to mineral lands, resulting in tying up in idleness large areas of every proved district in the West. This land is largely held, by virtue of low taxes, waiting for the day when someone, despite high royalties, makes a fortunate strike and gives it a value all unearned by the owner. We can look with some respect at the Mexican law, which rates mining as a public utility and does not grant title in fee simple to mineral deposits. We hear much of the leasing of coal and other government lands; I believe that the leasing of mineral lands would quicken the industry.

Second, inherent in the industry, is the geological fact that not all prospects and mines can make good.

Third, is the bad judgment on the part of the prospector and the small owner in exhausting his own resources and those of his friends (which means in the aggregate the resources of the community in money and credit) in development of worthless prospects or of good prospects in a bad way. His faith may be good, but he does not know. This, too, is inherent in the industry.

Effect of Inexperienced Owners

In some industries there is an orderly development of skill through the succeeding stages of apprentice, journeyman, superintendent, manager and owner, the latter a master workman in his industry, with all details of operation, accounting and organization practically a part of himself. Our industry does not ordinarily offer a parallel; in its nature it cannot, when a man of any vocation becomes an owner, but not a master workman, by the mere act of location. Our only approximate approach to an orderly evolution is in the case of the technical graduate, who goes faithfully through the various stages of apprenticeship by some one of various routes and finally becomes a master, be he manager, owner or engineer. There are notable exceptions, great miners who are notable executives without education in the schools, but I am dealing with the average man.

Fourth, and of a parcel with the preceding point. The owner of a prospect or small mine magnifies what he has and persuades an outsider to buy an interest or all on too severe terms. The buyer, his ignorance already shown by the terms of the purchase and likely without adequate capital, collapses before he can do sufficient development and construction.

Fifth, the preceding dangers to the property passed and a mine fairly started, it fails for lack of proper organization

and lack of technical skill. There is sometimes dishonesty, a final straw.

Suggested Remedies

To suggest what relief I can: I see no prospect that our fundamental law will be changed but I do see that a growth of public sentiment favoring reasonable terms of lease would be of great value. This would best be accomplished by the intervention of the local commercial bodies, which would work out standard systems of leasing adapted to the district or to sections of it, and secure the concurrence of owners of idle property. The terms might be such as would even be comparable with government leasing. I do not contemplate such leasing as will gut property, but terms that will favor development, with little or no royalty on ore recovered in development that is properly planned. This seems to me to be a legitimate and highly desirable community activity.

For the waste in developing hopeless prospects or good prospects in a bad or needlessly expensive way, there is just one help, and that is to secure good advice from a competent man. I mean hopeless prospects when I say it and have in mind those in areas reasonably proved to be hopeless, those in vein systems amply proved to be barren and such as are cut off by faults or in landslide blocks. These will serve as examples of this class, a small class at best, as compared with the fair or good prospects developed on a bad scheme or without any plan at all. For the waste in developing reasonable prospects that do not make good, I see no help with our knowledge in its present state. It seems a proper and necessary part of our work and, if the work is well planned and skillfully executed, the industry should profit in the long run.

The practice of making sales at too high a price or on too severe terms brings its own retribution to a district in stagnation, and in monuments in the shape of ill adapted or uncompleted plants. The terms of option and sale are essentially matters of private contract, but where unfair terms and misrepresentation bring discredit upon a district, an enlightened public sentiment may demand that it be heard and may demand good faith and fair terms. This is not chimerical, for I know of a case where a large enterprise is just now being resuscitated after years of idleness, where a good community spirit forced reasonable terms.

This community spirit may fairly show itself in pointing out to intending purchasers that they should safeguard themselves with the best engineering and geological advice, that if they are to take a partially developed property, their only safe plan is to follow a program of development mapped by competent authority and it can well aid in securing the time for the necessary development and equipment, before payments are scheduled to begin.

Sale of Mining Properties

There are two classes of property, at least, to which much of what I have said in this connection does not apply. A bonanza prospect is a law to itself, and a developed mine is subject to sale for cash with fairness to all parties immediately concerned and to the public.

Why the severe terms for prospects of small apparent value and for ill developed mines? The seller lacks faith in the property he is selling or in the ability of the buyer to make a success of the enterprise that he is undertaking. He takes the cash payment as insurance to himself against the poor results of development on the one hand and against the possible failure in management by the new owner on the other. It is not good practice, for this first sum should go into development, which often brings its pleasant surprises as well as its disappointments; and it is ample development that makes mines.

This is something that I believe to be reasonable: If in any mining district there is an orebody that bears the marks of good size and its grade is at or just below what can be worked with the equipment now at hand in the district, it may be recommended to outsiders for development or it may be developed by local people as an investment, with the reasonable assurance that, by the time a large tonnage is ready the means to treat it at a profit will be available. As a case in point in showing the steady progress in metallurgy, I understand that now, for the first time, cyanidation has been made adaptable to certain ores of this district. I say "made adaptable" advisedly, for that is the essence of engineering. I hope that it may prove a success and that you may have the courage and good fortune to develop orebodies of such size as to make the most of this branch of metallurgy. The men who have accomplished this result deserve the appreciation of their fellows.

Let the owner and community offer time for development and demand that development be done; it is at once a safeguard to the buyer and a sure test of his intentions and abilities. I believe that any district of real merit in which the people avowedly stood for this good practice would attract a good class of investors.

Organization Is Essential

The failure of the developed mine for lack of organization and technical skill is common and sad. At a time when business in general, your smallest grocer if you please, with his cash register and other appliances, is trying to make light the dark places, our industry remains in general archaic. I know a man of more than average intelligence, who runs a mine with the aid of a pocket memorandum and check book, as far as I can see. When the ore falls in grade, he will either change his methods or break; unfortunately he is not alone in his method.

The necessity of right organization is common to all mines and is merely the application of business principles. To properly organize is to provide the mechanism, the staff of men for supervision and the system of accounting and communication to make their work effective. The aversion to accounting in general among mine operating men results from the inapt and cumbrous nature of some systems in use and inappreciation of the benefits to be had from a good system, fitted to the needs of the individual mine. When a foreman explains that there is a great deal of red tape on the mine, it is a fair inference that the system is wrong or, if right, that man has not been taught to use it. Certainly, properly adapted accounting simplifies the work for manager, superintendent and foreman. There must be many figures, but the working out of the details of the accounting is to be concentrated in the hands of the clerk, where it belongs.

System Used at Liberty Bell

To the student of ways and means, citations from actual experience are of more value than theoretical conclusions and I will now cite to you a particular mine and outline its organization and methods, as a good example. The mine is the Liberty Bell and, the system in use having antedated my presence there, I can speak of it from the standpoint of user and observer. These principles underlie the scheme: the provision of adequate executive supervision; the definite placing of responsibility; the definite knowledge of every expenditure; the definite knowledge of mill results; and the requirement that everyone is in a position of responsibility to tell in the simplest way just what he has done. The staff organization is thus: (1) General manager and president (nonresident); (2) superintendent (resident); (3) chief clerk and cashier, with necessary subordinate clerks and boarding-house steward; engineer, with assistants as required by the work; mine foreman, with shift bosses and mine mechanic; tram foreman, with shift bosses; mill foreman, with one general assistant and shift bosses.

Each department head has well defined duties and a large measure of independence. In the system of reports and accounts is his bond with the superintendent and the latter's best means to gage the work of the foreman. In the figures that come back to the foreman is

his opportunity to know his own results. Any good foreman knows in some measure how his work progresses.

He cannot know this exactly without figures and this requires bookkeeping; if he does it himself, it will be at the expense of his essential work.

Records of the Foreman

To illustrate the foreman's relation to the general system in telling what he does and what he requires in the way of supplies, I will take the mine foreman, who turns in the following sheets daily: (1) Mine-labor report, which shows on its face how many men of every class were employed, surface and underground. (2) Mine-ore report, which gives the ore and waste produced and, what is to the point, if the tonnage of ore is below standard, the reason must be given there. (3) The daily log, a letter sheet which must go forward every day, blank or filled; if blank the foreman assumes the responsibility of reporting good conditions. Otherwise the opportunity is at hand to call attention of the superintendent to any condition of the work; and, what is most important to the foreman, it offers him scope for his own ideas; it permits him to make recommendations. This report definitely places the burden of responsibility between foreman and superintendent. (4) Requisition blanks, numbered, form the simple means of asking supplies. Beside the statement of the want, the essential addition is the purpose. The foreman has at hand the list of headings, to which it is customary to charge mine supplies and labor: foreman and shift boss; stoping; underground hauling; tunnel raise; blacksmithing; tracklaying and ditching; heating; lighting; telephones; air plant; electric plant; electric power; locomotives; cars; miscellaneous.

This short list the foreman knows and to the various headings he charges all labor and supplies. It is needless to say that the foreman retains copies of all reports and requisitions. These simple duties performed, he has fulfilled his part in initiating proper records. It is not complicated and cannot be a burden; in fact, the ordering of supplies is almost machine like at the end of each month. In return the superintendent supplies the foreman with the account complete at the end of the month, totals and summaries of all classes of labor and supplies and the cost per ton.

Reports of Department Heads

What the mine foreman does is typical of the duties of all foremen; and all reports go to the superintendent. In 15 minutes he will have entered the essential items of every report across his summary sheet. The entries on this sheet are, for the mine: tonnage, total labor, total underground labor, machine shifts; for the tramway: tonnage; for the mill: tonnage, total labor, amalgam product, concentrate product, tons cyanide solution and its value and other current assays. At a glance he can see whether any item shows change from the day, week or month previous.

The sheet is an index, *par excellence*. In the case of lowered tonnage in any department, the detail sheet gives the reason and so in the case of high labor or any other irregularity. The recurrence of trouble in any quarter suggests that any remedy theretofore applied has not proved adequate. In a word, the signals are automatic, and there is the crux, the simplicity of the system. Foreman, superintendent and manager, all see the daily reports and superintendent and manager see the summaries, and, for all, the clear sheets, with full tonnage and normal labor, show the perfect working machine and allow freedom to study some particular part of the work and to improve practice.

The word distribution is used to designate the name of the account to which the foreman on his requisition signifies that the cost of the item he orders is to go. This is never lost sight of. The order to the supply house, written in triplicate, has the notation on the office copies and, when the bill is received with the goods, it is entered thereon. At the end of the month, there remain only the totaling of the various distributions and the entry in the books. The reports of the various departments are then compiled and analyzed.

Store and Construction Accounts

The essential remaining features of the accounting may be discussed together. Ideal simplicity would accrue, if each item of labor or material could be given at once its proper and final distribution. This is not feasible, if one is to have the uniformity essential to comparison of results for different periods. The disturbing features are the purchase of some supplies in large quantities and the purchase and erection of machinery, buildings, etc., the former being distributed as used from month to month with exactness, and the latter approximately apportioned as depreciation through the assumed life of the mine. These equalizations are cared for by the "store" and "construction" accounts, respectively. Any purchase of supplies for use through an extended period, or for general use, is charged to the store when bought and then charged to the various departments at actual cost as used. All items going into any permanent construction are charged to their proper construction account, but after the construction is once complete, any further purchases are for repairs or maintenance and are charged off at once as operating expense.

I have given the salient features of a system that has proved of the greatest assistance in working out a difficult enterprise. My object in reviewing it is to drive home the fact that, as it touches the operating man, it is simplicity itself. It eliminates correspondence and conversation, the telephone being left for emergency use. It suits the needs of the staff men of all ranks. It is fundamentally the sort of system that the small mine can adapt with great profit.

This is not a meeting of accountants, but I propose to urge upon our organization the need of propaganda furnishing systems of mine accounting. The one fundamental principle should govern—the greatest accuracy compatible with simplicity and commensurate with the requirements of enterprises in various stages. Such work can be made invaluable.

Efficiency by Continuity

I have said that some mines fail for lack of technical skill. The mine I have mentioned was found in the prospect stage by an engineer, who later organized it for operation and has always directed its policies. The resulting continuity in plan and the constant accumulation of a fund of special knowledge have made the difference between success and failure. In the nature of things, not all mines can have this history, but the owners can secure good technical direction from men schooled by years of successful practice.

This may seem an unasked advertisement of the consulting engineer, but it is a statement of a logical course of action and it is the substance of what I have to say. A board of directors or a nontechnical manager, with faith in the engineer, secures the necessary continuity of policy and the accumulation and analyses of special knowledge.

There is no better illustration of the reasonableness of this advice than to draw a parallel with the professions of law and medicine. Men of these professions are essential to the everyday life and this is so because they are recognized as trained men. There are lawyers and doctors whom you do not trust and there are engineers who are not to be trusted. On the other hand, you of this vicinity do not have to think long to recall engineers of continent-wide practice won by sheer force of merit. The engineering schools turn out their annual crop of young men who, with good field training, will become competent. Not all will be great, but the mere fact of their training in the fundamentals will save them and their employers from the commonest mistakes which are so costly. That these graduates do not progress faster is due to the fact that they do not come oftener

under the direction of trained superiors in their early years out of school.

Resident and Nomad Engineers

T. A. Rickard some years ago entered a plea for the usefulness of the resident engineer, as against the nomad, as a source of consulting advice within a district, a man who will do intensive cultivation, if you please. For the good of the profession and the industry, there must be nomads, to carry good ideas and to keep the profession broad, where men too much in one place would become narrow. But this requirement becomes less with the increasing dissemination of good technical literature. The idea fits well with some of my own. I have felt that many graduates, who go in for assaying and surveying in our various communities, develop those lines into fine arts, but often shut themselves off from the larger opportunities and responsibilities, with detriment to themselves and the community. Is it not natural that the locator, who employs a surveyor to stake the claim properly, should ask his advice on the larger questions; whether the claim is hopeless; whether he sees any encouraging marks and whether he can suggest the most economical way to prospect it? So, with the owner or manager of property in more advanced stages, needing advice as to organization, operating methods or metallurgy.

To return to the analogy of the other professions; do you know a good local lawyer who does not consult a leader in his profession? The local engineer would have similar connections and would use them. A growing business, with the confidence of the community, would mean the gradual growth of an engineering staff and therewith the steady accretion of compilations of engineering data and the mining and metallurgical history of the small mines of the district that is now had only by the larger and well managed mines, a tangible asset to the community and the industry.

The expense of engineering advice is as essential as powder, and more so, for it can give direction to the powder, with resulting enormous savings. Such a system is for the future but we can gradually change to right lines. New conditions require new methods. The industry has had a chaotic history, in which the wealth of bonanzas has made skill superfluous. In parallel with the exhaustion of our richest deposits, has come the growth of our schools and scientific organizations and their product in men and ideas is the machinery for giving value to lower-grade ores.

There are certain phases of good management of operating mines that I wish to mention. There has been so much said of scientific management and some of the alleged examples are so bad that the expression is almost a byword in places.

Efficiency by Motion Study

Yet the principles enunciated as thoughtful consideration of every mine manager. Conditions vary so widely that it is quite impossible to make any fixed rules for the application of these principles, but each manager must analyze for himself every operation in mine, tramway and mill.

In the operation of the mechanical plant, the results, whether favorable or adverse, are evident and serve as a gage of the management. The equipment and its operation may both be archaic, it may represent the latest approved practice or it may be almost original. Whatever it is in this way, it may be in perfect order or slovenly; each condition reflects its own type of management. Very commonly the mine that hoists by cage and cars represents the archaic type of mind and where this method is in vogue, the entire organization will probably be on a par. That any manager today will use such a method for a large orebody is incomprehensible in view of the well known examples of better practice. Copper Queen methods of moving ore are in point. The train goes by the station and discharges without stopping. In turn, by the use of measuring chutes or fillers, filled from the pocket while the skip is running, the skip loading is almost instantaneous. What a contrast the two types represent, and what excuse can be offered for the continuance in use of what should be obsolete? The ability to halve the time of a cycle in hoisting means that one shift will do instead of two, or one shaft instead of two. The labor ratio between the two methods is likely to be 4:1.

I may cite an instance from my own experience. It was reported that the maximum output of a certain level was 160 tons daily with one locomotive. A reorganization of the tramming crew, adjustments of track with introduction of automatic switches and a few changes in method brought the product of this level to 500 tons for the same one locomotive. The secondary but more important result was that it immediately became possible to concentrate the mining of that tonnage on the one stope; the one level above was the route for all timber and permitted the use of a single power-driven saw. All supervision had its maximum efficiency. This result was no more than natural, following a right analysis of conditions existing with knowledge of the requirements.

Manager Should Be Analytical and Constructive

One type of mind starts with what has been done in the past as a basis for the future and reaches the future result by mere process of addition and multiplication; it assumes that a man who has mined, trammed, timbered and bossed is therefore competent as foreman and superintendent.

The other idea is that, together with a good working knowledge of the details of the work, there must be the capacity to interpret, the analytical mind; and the power to remedy defects found, the constructive mind. It has seemed to me that some of our schools pay too much attention to the petty details of operation, things ephemeral and likely to be obsolete in comparatively little time, and too little time to the purely scientific and fundamental, which will force students to depths sufficient to develop the best that is in them.

There is danger in what is too new, for pioneering is costly. But for almost all mines tried methods, recently developed perhaps, but accepted and proved, are available. Therefore the use of the untried is seldom warranted. When it is a last resort, skilled direction is particularly necessary. I have assumed that the operator should know and would know the latest accepted methods. I mean just this, for I believe that any manager or superintendent who does not give time each year to visiting other mines will probably become incompetent by reason of his coating of rust. It is essential and he does not need to confine himself to gold or copper or lead mines. Let him visit the coal mines and see to what extent their movements are automatic, automatic because they can not afford to trifle with the handling of coal. Of course, he may be a loyal quartz miner and merely feel glad that he does not have to handle anything that must be moved so cheaply.

Lessons from Other Mines

We have had the grace to copy the coal miner's washery and picking belt with gratifying results. Henry M. Adkinson[1] tells of dump washing and sorting by which material worth $3.73 was converted into $8.36 mill heads at a cost of 21c., and discarding 55 per cent. of the tonnage taken from the dump. He goes further and shows that he was able to alter mine-stoping methods at a saving of 50 per cent. in the cost, while the cost of sorting out the somewhat increased tonnage of waste mines with the ore was but a few cents. The net result was excellent. This is an admirable case of nice adaptation of the means to the end.

Concentration of effort is always profitable and in mining it may be made so in driving one heading at high speed instead of two at half that speed. Supervision is easier and the result in doubling the amount of ore available at one time and one place is of great importance.

[1]Eng. and Min. Journ., July 22, 1911.

The idea of consolidation of adjoining properties of the same character follows as a corollary. To cite further instances is to reiterate, though there are many examples of extraordinary results from the application of great skill to a poor quality of raw material in the form of ore.

I believe that any community must understand the basic principles of the industry by which it lives. I apply this with special force to the mining communities, which must recognize that any continuous prosperity must have as foundation the principle of intelligently making use of trained men and scientific methods. As for the engineer and manager, to be worthy of his title and to command the respect of the community for his training he must be alive to all the possibilities in his work; his methods must be cleaner cut and his results more certain. To too many, a mining education is merely a license to make a living in mining, wthout any recognition of the corresponding obligation to the state and the industry. To secure satisfactory results the community and the engineer must each recognize the obligations imposed and unite their efforts for the common good.

Zinc Separation Method

The following method for the separation and recovery of zinc from ores and other metalliferous substances has been patented by T. Huntington, Pertusola, Italy (*Journ. Soc. Chem. Ind.*, Nov. 30, 1911). The powdered material, mixed with fuel, is charged into a closed converter provided with a water- or air-cooled grate. The charge is ignited at the top and a current of hot air is forced through the mass in a downward direction, the conditions being such that zinc vapor is produced and subsequently condensed by its passage through the openings in the cooled grate. Limestone, iron ore, silica and other materials are added to the charge in such proportions as to effect sintering, but not fusion, at a temperature somewhat above that necessary for the reduction and volatilization of the zinc.

Lonely Reef Gold Mine

JOHANNESBURG CORRESPONDENCE

This mine is in the Bembesi district of Rhodesia about 55 miles north from Bulawayo. Attention was attracted to the rich outcrop by a small working made by the ancients. As its name implies, it is situated many miles from the gold belt as then known. Its ownership became the subject of lawsuits, it being alleged that the man who pegged the claim had been sent out as agent for another and that the pegging itself was not correctly done. The holders, however, triumphed and to the end of 1909 had crushed 20,348 tons of ore recovering gold worth $500,000.

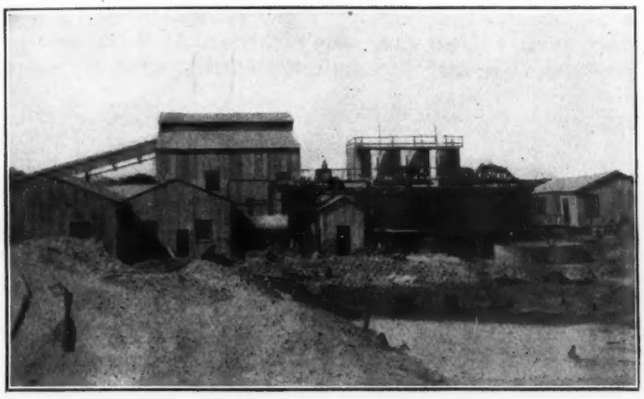
Development had been extended down to the third level, the shoot of ore on the first level had been proved to be 1000 ft. in length, averaging 33 in. in width and the value of ore in sight was about £120,000 when a company was formed in January, 1910, with a capital of 325,000, £1-shares, 271,000 being issued and £120,000 cash and 75,000 shares being paid to the vendors.

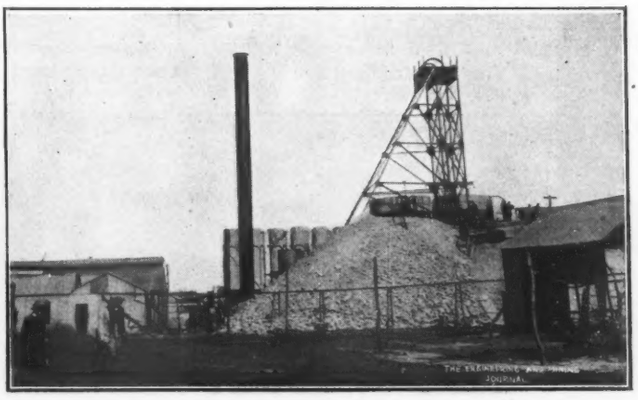
VEIN DEVELOPED TO DEPTH OF 800 FEET

During 1910, 15,173 tons yielded £40,000, and on March 31, 1911, there was fully developed to the sixth level 120,000 tons of ore assaying 22 dwt. over a width of 36 in. The vein has recently been cut at the fourth or 800-ft. level, assaying 2 oz. over 54 in. width.

The length of oreshoot at fourth level was 918 ft., at the fifth, 960 ft.; the sixth level has been driven 694 ft. The estimated profit in sight is about £400,000 and the 271,000 issued shares are valued at about £3 8s. The mine seems everything that a quartz mine should be with a long uninterrupted shoot of ore with gold content well maintained or increasing to the present depth. The vein runs nearly north and south in a serpentinized basic rock near its contact with a porphyry dike. Its dip is nearly vertical.

A plant to treat 4000 tons per month has recently been designed and building started by C. B. Kingston, of which he furnishes the following description: The ore is conveyed from the shaft to the crusher station by inclined tracks which deliver the loaded trucks and return empties automatically. The crushed ore is conveyed by an 18-in. Robins belt conveyor to the battery bins. Between the battery feeder and mortar box a screen is introduced upon which a jet of water plays and separates the fines which do not enter the battery box but are fed direct to tube mills. Coarse screening is employed in the fifteen 1250-lb. stamps. The crushed ore is raised by two Frenier pumps to Caldecott cones and the underflow passes to two tube mills and the overflow to four Dorr thickeners. A 50 per cent. pulp is discharged to slow-motion ram pumps which elevate it to one of the Pachuca vats. Two shaking amalgamating tables are placed to take the discharge from the tube mills. The pulp is agitated for four to six hours when all the gold is dissolved and is then pumped to pressure filter presses. These were installed owing to scarcity of water, the water supply to the mine being limited. The solution goes to zinc boxes. Practically all the ore is reduced to less than 90 mesh. The battery is driven by a 250-h.p. Bellis-Morcum engine. The ore consists of a bluish quartz with secondary quartz and calcite veins in it. Generally the gold is fairly fine and associated with iron and copper pyrite.





STAMP MILL AND HEADFRAME AT LONELY REEF MINE, RHODESIA

The supposed deposit of graphite in Three Mile Creek cañon, between Brigham City and Willard, Utah, consists of carbonaceous schists. The schists outcrop on the south side of the cañon and show a black, lustrous polish resembling graphite, especially in joints or on the foliation of the rock. Tests, made by the U. S. Geological Survey (*Bull.* 430), showed that the carbon burned off in the flame of an ordinary Bunsen burner, indicating that the substance is more in the nature of an impure coal than of graphite. The material may possibly be of value as a pigment. In three samples the fixed carbon varied from 3.48 to 5.59 per cent.

Storage Battery Mine Locomotive

By H. B. Barnes*

Description of the equipment and operation of an Edison storage-battery locomotive recently installed at the Big Five tunnel, Idaho Springs, Colorado.

*H. B. Barnes & F. S. Youtsey, engineers, Denver, Colo.

The electric locomotive recently placed in service at the property of the Big Five Tunnel, Ore Reduction & Transportation Co., at Idaho Springs, Colo., is of particular interest to the mining industry as being the first application of the Edison storage battery to work of this nature on such an extensive scale as is here undertaken. The locomotive was placed in service early in November and has proved conclusively its ability to handle the traffic for which it was designed, and also the fact that the problem of the storage-battery locomotive has been greatly simplified by the introduction of the Edison battery, with which this machine is equipped.

Equipment and Arrangement

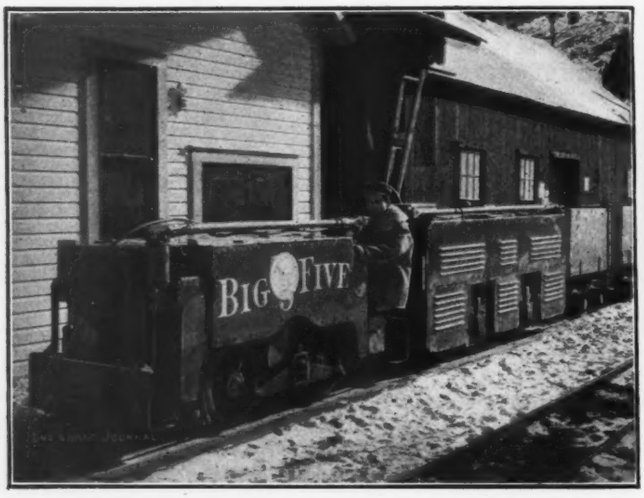
The locomotive is made up of two parts, the locomotive proper and the battery car or tender in which the storage battery is carried. The locomotive is of the so called "Scotch yoke" type, which is especially adapted for use in narrow workings. This construction has a number of points of especial value for use in connection with mine locomotives, which will be evident upon close examination. The outside connecting rods and the drive to the axles by means of the "Scotch yoke" permits the frames to be placed between the wheels with the motors carried well up on top of the frames, making them particularly accessible and free from dust and splash from the track. For narrow-gage tracks this construction permits the width of the locomotive to be kept down to the absolute minimum, while in no way cramping the motors or other parts as is frequently necessary where the motors are partly or wholly carried between the wheels. The vertical movement of the crankpin brasses in the slot of the yoke permits free spring action without in any way interfering with the drive, thus allowing the entire weight of the locomotive, less wheels, axles and side rods, to be spring supported, which contributes to easy riding of the locomotive and to a reduced wear and tear on the track. The fact that both motors drive to a common shaft which in turn drives all four wheels permits the electrical advantages of series or parallel operation with perfect assurance that an effective drive will be obtained in either case, as it is obvious that no wheels can slip unless all slip.

The Big Five locomotive has the following general specifications: Track, 24-in. gage; two 17-hp. motors; wheel base, 36 in.; diameter of drivers, 20 in.; width overall, 38 in.; height overall, 50 in.; length over end frames, 108 in.; weight, 4 tons; full load speed, 4.5 miles per hour. The tender weighs about four tons complete. The locomotive handles trains of 20 to 30 cars, of gross weight of approximately 2½ tons each, on the prevailing tunnel grade of 3 in. per 100 ft. The power required to pull the loaded cars out of the tunnel is practically the same as that required to take the empty cars in.

The present layout at the Big Five tunnel comprises about four miles of underground trackage and about 1½ miles of outside tracks extending to the various mills and dumps of the district. As there is no objection to the installation of overhead-trolley wires outside, while their use is desirable for several reasons, the locomotive and tender are equipped with standard under-running trolleys and the control is so arranged that the changes from battery to trolley operation and *vice versa,* can be made quickly and without stopping the train, all that is necessary being to put the trolley on or off the wire, and to throw a changing switch which is within easy reach of the motorman.

The conditions of part trolley and part battery operation, and the necessity for keeping the weight per wheel down, on account of the light rail in use (20 lb. in the main tunnel and 12 lb. in some laterals), were the chief factors in influencing the engineers in their decision to use the double-unit type of locomotive; as opposed to the more familiar type having the battery carried on the locomotive itself.

In the cycle of operations for which the locomotive was designed it is proposed to handle all the underground traffic with the battery; and in coming out of the tunnel to push the tender ahead of the locomotive. Upon arriving at the mouth of the tunnel the tender will be placed on a side track accessible for charging, while the weighing, switching and outside haulage to dumps, mills, etc., is handled by means of the trolley which is an admittedly more efficient application of the power than any type of storage battery. A second trolley is mount-



Storage-battery Locomotive, and Tender Carrying Batteries and Control Panel—In Use at Idaho Springs, Colo.

ed on the tender, the arrangement of the two being such that the one on the locomotive is used going into the tunnel and the one on the tender coming out.

Storage Battery of 208 Cells

The principal point of interest in the installation is, of course, the storage battery, which is unique in that it constitutes the first installation of a storage battery of this capacity in this class of work. The battery equipment consists of 208 cells of the "A6" type of the latest improved Edison iron-nickel battery, rated at 225 ampere-hours capacity. The construction of the battery is radically different from the familiar type of lead-lead battery in that the active materials are oxides of iron and nickel in a solution of caustic potash. The active materials are held in perforated steel tubes mounted on pressed-steel grids, and the complete element is encased in a sheet-steel jar. The cells are assembled in trays holding eight cells each and there are 26 of these trays, 17 on the upper tier and nine on the lower.

Battery Recharged at 385 Volts

The recharging is carried on by means of a motor-generator set situated in the power house, which consists of a 50-hp., 2200-volt, three-phase, 60-cycle induction motor, direct connected to a 37½-kw. special type of interpole direct-current generator. This generator has an unusual voltage range, being designed to operate at 250 volts for the operation of the locomotive by means of the trolley, and being capable also of generating up to 400 volts, the voltage necessary to completely charge 208 cells of Edison battery being 385.

The locomotive battery has storage capacity for approximately five round-trips under the present conditions of operation over a three-mile route which involves handling the entire traffic by means of battery, as the trolley equipment has not yet been installed. Owing to the peculiar operating characteristics of the Edison battery which has extremely high ampere-hour efficiency, but rather low watt-hour efficiency, it has been found desirable to use short, frequent charges rather than long continued charges which are necessary only when the maximum output of the battery is required. The custom at the Big Five tunnel is to give the battery a charge of an hour or two night and morning, and a one-hour boost during the lunch hour at noon, thus securing the maximum watt-hour efficiency from the power expended. The Edison battery has the quality of being able to stand to a remarkable extent, high charge and discharge rates without injury, it being possible under certain conditions to give a battery 50% of a full charge in one hour's time.

The recharging connection is made in the motor house by means of a plug and flexible cable similar to that used for automobile work, and the entire operation of connecting to the charging circuit and starting up the motor-generator set can be easily accomplished in 30 sec. Suitable indicating and recording meters consisting of voltmeter, ammeter and ampere-hour meter are mounted on the control panel on the tender, by means of which the condition of the battery may be determined at any time.

The locomotive has not been in operation long enough to obtain sufficient data to determine accurately the operating and maintenance costs. It is not expected that these will be as low as with an all-trolley system, but it is known that the cost is considerably less than the horse haulage, which it superseded, while the value of the convenience and safety of the storage-battery arrangement cannot be estimated.

The battery is guaranteed to have 90% of its rated capacity at the end of three years of work, and as the construction of the cell is of steel throughout and no cleaning is required, the maintenance expense should be small. The only attention required by the battery other than charging, is the filling up of the cells three or four times a month with distilled water to replace the losses caused by the decomposition of the water in the electrolyte due to the chemical reactions consequent upon its operation. In the accompanying illustration one of the trays is shown drawn out of the tender for inspection and filling, which shows the easy accessibility of the battery as arranged. This cut shows also the control panel containing the meters and the switches for changing from battery to trolley operation and *vice versa*, and for operating the head and pilot lights on the tender.

The entire electrical installation was furnished by the Westinghouse Electric & Manufacturing Co. and the Baldwin Locomotive Works, the details of the design being worked out by the engineers of these companies, working in conjunction with the firm of H. B. Barnes & F. S. Youtsey, of Denver, engineers for the Big Five Co., who also supervised the installation of the equipment and are in charge of its operation.

Meerschaum Mining in Asia Minor

Meerschaum, a silicate of magnesia, is mined at Eski-Chehir, on the Anatolian Ry., in the province of Brussa; according to the *Mining Journal*. The deposis now being worked are in the vicinity of the villages of Sepetdji, Kemikli and Sarisou, around Eski-Chehir. The pits vary considerably in depth. The first evidence of the presence of magnesite is a layer about 3 ft. thick of Fuller's earth. This reddish brown earth is met at a depth varying from a few to 20 yd. beneath the surface, but such depths as 40 yd. and more are not unknown. The meerschaum is found in this layer of earth in nodules, the size of which rarely exceeds 12 to 16 cu.in., while the majority are not larger than a walnut. The entire output goes to Vienna, whence it is redistributed all over the world.

Operating Data of Golden Horse Shoe Mine

According to J. W. Sutherland[1], general manager of the Golden Horse-Shoe Estates Co., Ltd., an average of 606 men were employed in the year 1910 at this mine adjoining the Ivanhoe and Great Boulder Proprietary mines at Kalgoorlie, Western Australia.

During the year 239,324 long tons of ore was broken and raised from the stopes and 18,709 long tons in development work. The average tonnage per man per shift, based on the total number of men actually engaged in underground work (606) was 1.356 tons; average tonnage per man per shift, based on total number of men actually engaged in stoping and filling ore into chutes (274) 2.818 tons.

The work was done in the equivalent of 310 working days. In this time 120,080 hand, 275,647 machine drills and 308 picks were sharpened. The candles used weighed 79,580 lb.; 134,000 ft. of jarrah, 1,100,000 ft. of round and 83,000 ft. of Oregon timber were used. Of explosives, 99.12 tons of gelignite and 37.98 tons of blasting gelatin were used, requiring 148,200 detonators and 34,198 coils of fuse.

In stoping, 0.84 lb. of explosive was used per ton of ore; in drifting, 11.61 lb. per ft. of drift; in crosscutting, 10.14 lb. per ft. of crosscut; in shaft sinking, 13.67 lb. per ft. sunk.

The average total number of 3⅝-in. machine drills in constant use throughout the mine was 36.33. In stoping an average of 26.33 machines were in use each shift, 80,351 holes were drilled to an average depth of 6.91 ft., a total of 105.1 miles or 554,908 ft. and an average of 21.77 ft. of hole was drilled per machine per shift, corresponding to an average of 9.39 tons of ore broken per machine shift.

In development work, the average number of machines in use was 10; 5812 ft. of drifting and crosscutting, 3314 ft. of raises, passes and winzes was done. In the shafts a total depth of 927 ft. was sunk and 390 ft. of hole bored by diamond drills.

[1]Monthly Journal of the Chamber of Mines of Western Australia, September, 1911.

Traveling in Colombia

By R. D. O. Johnson*

An account of the varied conditions encountered in Colombia, with suggestions of value to engineers who may be going to this interesting country for the first time.

*Mining engineer, Apartado 110, Medellin, Colombia, S. A.

When a knowledge of Colombia's mining resources, particularly those of placer mining, becomes more generally disseminated and the baseless fear of the "pestilential" climate is dissipated, the inevitable interest in this country on the part of the mining fraternity of the States will first manifest itself in a great increase in the number of visitors to this country. But traveling in this country is beset with difficulties, not to say dangers. These may be greatly mitigated or entirely avoided by a foreknowledge which, it is hoped, may be in some measure supplied by this article.

The information herein contained has been gathered during a year's traveling, confined almost entirely to the Department of Antioquia, and from travelers from other parts of Colombia.

Colombians Friendly

The people of Colombia are unfeignedly friendly to Americans and to American interests. Any notion to the contrary should be dismissed forthwith. There is an abundance of genuine civility and courtesy shown to strangers, even by the peon classes. The upper classes are polite and gracious, sometimes in painful contrast to the brusque and abrupt manners of the American. The American who unbends and adopts a more profuse politeness than is called for by the customs of the States and does not attempt to rush his business deals, gets along better. The Colombian is a born *negociador*. In a business proposition, he covers the ground to the last microscopic detail. He is shrewd and entirely capable of taking care of himself. He cannot be successfully hurried.

A stranger entering a back-country village creates as much commotion and excitement as a circus in a rural community in the States. He has the opportunity of knowing the sensations of the elephant. The curiosity of the natives is so intense and so insatiable as to become annoying. It is silent, childlike, open-eyed and open-mouthed, but without a suggestion of insolence. It is best to patiently endure it, for such curiosity is but the natural result of their hermit-like existence.

The intending visitor to Colombia should provide himself with a passport, to be obtained from the Department of State at Washington. It is also necessary to have the passport viséd at the office of the Colombian consul general, at 22 State St., New York.

As Spanish is the language of the country, the visitor should possess a working knowledge of the tongue or secure the services of a competent interpreter. Interpreters are not plentiful. There are many persons in business in the coast cities and in the larger cities of the interior who speak both English and Spanish, but few of them are at liberty to take positions as interpreters. The students in the colleges in such cities as Medellin have been quick to recognize the opportunities that are open to those having a working knowledge of English and are now diligently applying themselves to the study of the language. Few, however, are as yet competent to undertake the duties of interpreter.

Ports of Entry

The traveler for Colombia may enter at either Cartagena or Puerto Colombia. The latter is practically the harbor of Barranquilla, a city of 60,000 inhabitants and the principal commercial center of the republic. It is usually necessary to remain from four to six days, after landing, in either Cartagena or Barranquilla, awaiting the departure of a steamboat going up the Magdalena River. Barranquilla is the lower terminus of the routes of the river boats and is the best point for securing passage and accommodations on them. Cartagena being on the coast, 60 miles by rail from the river, parties awaiting there not infrequently find the staterooms all sold and only accommodations of a second class available upon their arrival from Cartagena at the river port Calamar.

The climate of Barranquilla is much cooler and generally more comfortable than that of Cartagena. The latter offers some compensation for its tropical heat in the historic associations that invest the city. It is said to be the only walled city in the Western Hemisphere. The medieval atmosphere of the place is reminiscent of the buccaneering exploits of Morgan and the pirates of the Spanish Main.

Protection against Mosquitoes

A trip into the interior must be preceded by a voyage up the Magdalena River of from six to nine days' duration. On the whole, this voyage is delightful, but is attended by dangers against which the prudent will take measures to protect himself. The steamboats make frequent landings and, when these are made at night, the mosquitoes swarm aboard in great numbers. For comfort as well as safety, the traveler should be provided with a stout and well made mosquito bar. The most satisfactory material for this most necessary article is a close-mesh bobbinet. A good bar of this material will cost from $6 to $8. Economy in the mosquito bar may prove to be of a very expensive variety, if the cheap one permits the entrance of the malaria-bearing mosquitoes. The material known ordinarily as "mosquito bar" is of no value. It will not stand wear and shortly becomes worse than useless.

The mosquito bar (called a *toldo* in this country) should be made about a foot wider and a foot longer than the cot it proposes to cover. The sides should be about 6 ft. high, including a 1-ft. strip of muslin at the bottom edge. A good *toldo* is the best preventative of malaria. In use, the sides of the *toldo* are brought down and tucked under the edges of the blanket or the sheet on the canvas cot. This should be done during the day or before sunset. Just before turning in may be too late as the mosquitoes may be hanging thick over the *toldo* at that time.

Low shoes should be discarded for this trip. The mosquitoes possess an unerring instinct that leads them directly to the vulnerable region that lies between spring trousers and low shoes. The prudent traveler provides against the inevitable bites of the most enterprising mosquitoes with daily doses of from four to six grains of quinine in capsules.

Baggage in Small Units

Travelers entering this country for the first time generally make the mistake of having their baggage in units too large. They overlook the fact, or else are uninformed about it, that the baggage must be transported inland, on mule back. The weight of the individual pieces, generally, should not exceed half a *carga*. Depending upon the size of the mule, the character of the trail to be traversed and the length of the journey to be made, a *carga* will weigh between 150 and 200 lb. (six to eight *arrobas*). A steamer trunk having the dimensions 28x17x13 in., packed tight and weighing between 75 and 100 lb., is the most desirable unit. A traveler with such baggage will find no difficulty in closing a contract at reasonable figures for the transportation to its destination. The numerous *arrieros* to be found at every terminus where the traveler commences his muleback journey will contend for the opportunity of carrying such de-

sirable freight. The traveler who arrives with the big "Saratoga" solidly packed will find his freight business going begging. After much wearisome negotiating, he may find himself forced to unpack his big trunk and to distribute its contents into several boxes or such packages as he can find or he may be reduced to the necessity of having the great package carried between two mules, a method expensive and slow. The big trunk makes one trip only.

Satchels and suit cases are not designed to resist successfully the kind of handling they receive in being carried on muleback. The lashing and tieing down necessary to secure them on the animals generally break or bend their frames. It requires but a few trips to put them out of commission. Besides the small steamer trunk a convenient piece of baggage is the leather telescope. But for interior or back-country traveling, by far the most useful and satisfactory containers for the traveler's belongings are a pair of huge leather bags constructed on the pattern of the ordinary saddle bags. These bags are carried by the pack mule and constitute his *carga*. Mining engineers find these bags particularly serviceable for carrying samples as well as personal belongings.

Each piece of baggage should be provided with a waterproof covering. If the traveler does not care to go to the expense of having covers made of waterproof canvas, he can secure at either Cartagena or Barranquilla a waterproof cloth of coarse texture, called *encerrado*, for wrapping his baggage. This material serves for one or two trips only. If the traveler contemplates many trips into the interior, he will find the canvas covers much more satisfactory and cheaper in the long run.

The Mule Problem

The mule problem is one that engages seriously the attention of the experienced traveler. He finds it cheaper and much more satisfactory to own his mules rather than to depend upon renting them. He will buy none but good mules, high-priced ones, and will not depend upon one alone. The work of carrying the traveler over the Andean trails is too hard for one mule. Two mules will last more than twice as long as one. He rides them on alternate days. Jack mules, *machos* as they are called by the natives, are to be preferred to mare mules.

It is best to buy the saddle, bridle and halters in Colombia. American-made saddles do not fit the mules here. With the saddle should be purchased a pair of saddle bags and a "*concha*" cover. The *concha*, or raincoat or cape is an important article in the equipment. The "officers' riding rain cape" is light and serviceable, though many prefer *conchas* with sleeves. A cheap and leaky *concha* may be the source of no small amount of discomfort. It pays to get a good one. A pair of waterproof, high-topped, "expert" boots, hunters' suit of waterproof duck and hat of the same material round out a servicable outfit.

Take a Few Well Chosen Medicines

The new traveler in Colombia, having heard exaggerated tales of the pestilential character of the climate, generally enters with a large supply of medicines, 95% of which he subsequently finds unnecessary. In every large city are plenty of drug stores that carry large stocks nearly as complete as any in the United States. In these cities are capable physicians, many of whom have received their degrees in Europe or the United States. Dependence upon these physicians is much to be preferred to self-medication. However, if the traveler intends going far into the interior at a considerable distance from the larger towns it is desirable to take along a limited supply of medicines. Calomel tablets and cathartic pills will be found serviceable as it is the experience that the liver is liable to become torpid in this country.

Cuts and skin abrasions should not be neglected. No matter how small or seemingly insignificant, they should be sterilized and covered with adhesive plaster. Without such precautions they are likely to become infected and fester.

If travel in the hot countries be contemplated, quinine in two- to five-grain capsules should form a part of the medical outfit. In addition, some travelers carry a hypodermic syringe and sealed tubes containing hydrochlorate of quinine. Each tube contains a dose equal to 25 grains of quinine. (Put up by Polenc Frères, Sièrce Social, 92 Rue Vieille du Temple, Paris, France.) The hypodermic application of such heroic doses is only to be resorted to in the event of having contracted a severe case of malaria. Quinine thus applied, however, is very effective and promptly "breaks" the fever. Careful sterlization, not only of the needle and syringe, but of the skin at the point of application, should precede the injection.

Little dependence is to be put upon quinine put up in the small, white, hard, sugar-coated pills. The coating is so resistant to solution that the pills may pass entirely through the alimentary canal practically unaltered.

There should be added to the above medical outfit certain preparations intended to counteract the effects of the bites of poisonous snakes, if travel in the low, hot country be contemplated. In some regions of rather limited area, poisonous snakes are sufficiently numerous to justify the provision of such medicines. The anti-venomous serum prepared at the Pasteur Institute in France is strongly recommended. This serum is put up in dried form in sealed glass tubes. It may be purchased from the Pasteur Vaccine Co., 366 West Eleventh St., New York. Some authorities recommend the use of chromic acid for preventing the absorption of the snake venom. Small and shallow subcutaneous injections are made surrounding the bite. In the higher and cooler regions, snakes of any kind are rare. These regions are also singularly free from noxious or pestiferous insects, fleas always excepted.

Attention to Kit and Mules

Traveling in the interior is hard work and difficult at best. At worst, in the rainy seasons, it may be next to impossible. The experienced traveler undertakes the task of a long journey seriously and prepares for it carefully. He surveys every detail of his already tested outfit and has it put in repair if necessary. For days in advance he has given personal attention to the care and feeding of his mules. If they have been long on pasture, he has his peon exercise them so that they may not be too soft for the days of drudgery before them. Unless he has something of the naturalist in him, the long days of dreary moiling up the rocky Andean trails will give him but little pleasure in anticipation. But to the naturalist every turn of the trail will reveal something stimulating and interesting.

The traveler is always, or always should be, accompanied by a peon. A good peon may be employed for 20c. per day and his board. He walks and drives the extra mule and the pack mule, if there is one, takes care of the animals and the pack at the stopping places and, generally, occupies the position of personal servant. There are good loyal peons who look out sharply for the interests of their employers and there are grafters among them who sell the corn intended to feed the mules and otherwise take advantage of the ignorance or lack of attention on the part of the travelers.

An experienced traveler in this country, unless he is so fortunate as to have a peon he can trust, will insist upon seeing his mules fed and will watch them until they have finished. Unhappy experience teaches the traveler that he makes but little progress over the Andean trails with underfed mules. Corn is high priced and, being the standard article of Colombian diet, is always salable. The keepers of the inns or *posadas*, as they are called, are rarely hurt with too much honesty. Individually they are most suave and polite. They will see to it personally that each mule is supplied with the prescribed two *puchas* of corn and, if vigilance is re-

laxed, will show equal attention to the removal of the corn before the mules have had more than a taste of it.

Posadas and Their Keepers

The traveler usually tries to gage his daily journeys so that he may arrive at a *posada* late in the afternoon. Upon his arrival, if he is wise, he will inquire the prices for the night's lodging, the price of each meal and the keep of the mules before he dismounts. Dismounting previous to making such inquiries indicates an intention to stop for the night and, as a result, prices mount rapidly. If he has neglected entirely to inquire concerning the prices until the time of his departure in the morning, he finds the polite suavity of the host has entirely disappeared. The grim-visaged innkeeper presents a bill that is about four times as large as it should be. The American, generally, pockets his wrath at the extortion, pays the bill and rides away. The French or German traveler will volubly denounce the pirate, call him several varieties of a *ladron* and, after half an hour devoted to talk, gesticulation and bad temper, likewise pay the bill and ride away. The fault lies with the traveler in not knowing or in neglecting his knowledge of the customs of innkeepers in this country.

The beds provided at these *posadas* are "some hard," as the cowboys say. They are not provided with Ostermoor mattresses. In fact, they are about as comfortable as a cement sidewalk. However, the discomforts of these beds are generally unnoticed by reason of their being infested by a particularly savage variety of fleas. Nothing can surpass the capacity of these pestiferous insects for creating forgetfulness of all other discomforts. Any remarks directed to the innkeeper in the morning concerning the ravages on the night's rest committed by these insects elicits the dry answer "that in all probability the fleas were very hungry as no one had slept in that bed for a week." Some travelers solve the problem of getting a good night's rest by taking with them the regulation army folding cots and their own blankets. One traveler solved the flea problem by providing himself with an extra long night shirt. This shirt was fitted with drawing strings at the neck, wrists and at the bottom. Upon retiring, he would draw up these strings as tight as comfort would permit, tie them and dismiss all anxiety about fleas. He stated that, aside from the fact that the fleas would occasionally pick and untie the most complicated knots in the drawing strings, he was troubled no more from this very fertile source of discomfort.

Trails Cut Blindly through Jungles

Except in few instances, the trails of Colombia seem to have deviated but little from the lines of the foot trails the aborigines hewed through the tropical jungle. But few have received the attention of the engineer striving to reduce the grades to a minimum. It is not to be expected that trails cut blindly through dense tropical growths would be on best locations. When the population increased, the jungle was cleared up and the land put in cultivation; the trails became the property boundary lines. Changing the trails became more difficult; there was a lack of effective public sentiment demanding it, so the trails remain today as they were originally cut out by the Indians long before the Spanish conquest. The trails between the principal centers of population have been, in many places, modified to better grade lines. But by far the great majority of the trails seem to have been laid out with the single idea of passing over the highest points and through the deepest valleys.

The trails are maintained on the same system of poll tax that prevails in the States. In the dry seasons they are good or fair; in the wet seasons with much traffic they become nearly impassable. In navigating them, it is necessary to use the same kind of judgment that becomes second nature or second sight to the old river pilot who for a lifetime has steered his craft around shifting sandbars. If the traveler is experienced, a good horseman, not easily excited and has plenty of luck he may remain aboard his floundering mule to the end of the trip. It not infrequently happens, however, that the traveler finds his mule struggling hopelessly in a mud hole seemingly bottomless. In such an event, it is necessary to dismount in the mud and with the aid of the peon get the mule out of his difficulty. After five or six such nerve-racking experiences during the day, the traveler is ready to turn in at the first *posada* and get such rest as the place affords. At this point the services of the peon are much appreciated. He cleans up the muddy outfit and has it in something like presentable shape by the morning.

The seat of the difficulty with these roads lies in improper drainage. The roads are repaired during the dry seasons and most elaborate efforts at drainage are made. For a time after the rains commence, the methods employed for securing proper drainage are sufficient to keep the roads in good condition, but these results are lost by failure to maintain repairs. The same criticism may justly be applied to the roads of any country, and is particularly applicable to the rural districts of the States. The washing rains of the wet seasons cut the trails down. During the dry seasons, the channels and holes cut by the rains are filled from excavations made at the sides of the trails. The operation of these two processes continued for a hundred years results in the trails being deepened and broadened. Trails that were probably not over three feet in width at first are now from 30 to 50 ft. wide and at the bottom of channels in some places 30 ft. deep. The new traveler, anxious to see the scenery and to view the country, is baffled in his desire by the necessity of riding between the high walls of the trails. his view limited to a short stretch of trail fore and aft.

The Mountain Trails

In the most mountainous parts the trails are rocky and rough in the extreme. At many points the traveler will prefer to walk while his mule lunges over the boulders or scrambles up precipitous places that would bluff any riding animal but a Colombian mule.

Passing in every direction across the country between the mule trails are foot trails or *trochas,* as they are called by the natives. These constitute the short cuts. In going from one point to another, the peon following these *trochas* easily outstrips the man riding the more circuitous mule trails. These *trochas* pass over the roughest parts of the country, so rough and precipitous that it would seem that none but native Colombians could successfully negotiate them. They extend into the rough country far beyond the regions where it is possible to build mule trails. Many of these trails that are dangerous to the unpracticed foreigner are traversed with seeming ease by the natives carrying packs weighing from 50 to 75 lb. When it happens that the mining engineer, in the pursuit of the duties of his profession, is called upon to traverse some of the easiest of these "monkey" trails, he returns with some very vivid recollections not unlike those acquired by the Alpine climber.

A New Use for Cadmium

A new use reported for cadmium is in connection with making the tungsten filaments for electric lights. The melting point of tungsten is too high to permit of the metal's being cast and drawn into wire, so an alloy of: Cd, 42 parts; Hg, 53, and Bi, 5 parts, is made up, with which the heavy black powder obtained by the reduction of tungstic oxide is incorporated by heating and grinding in a mortar[1]. Wires are then made by an extrusion method similar to those used in making lead pipe, after which the wire is heated to drive off the alloy. It is then still further heated *in vacuo* to render the tungsten solid.

[1]*Brass World,* November, 1911.

The Shape of a Shaft

By E. Mackay Heriot *

Shafts may be either rectangular, oval or circular and the prevalence of one type in certain districts is largely due to custom. Rectangular shafts have comparatively few advantages; circular shafts urged as safer and cheaper.

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Some time ago the statement was made in the columns of the JOURNAL that it would be interesting to know why certain districts characterized by similar conditions adhere so strongly to one special type of shaft. So far as I know, no attempt has been made to answer this question. As a rule the English colliery pits are circular, the Scotch rectangular, and in Wales oval and elliptical are often met with. The great German coal and salt fields now use the circular form, whereas rectangular shafts are most common in the United States. In ore mining shafts are generally of the latter shape, but there are exceptions, such as the Cartagena lead-zinc mining district, where circular forms are used.

RECTANGULAR SHAFTS SOMETIMES NECESSARY

Rectangular shafts are necessary where timber is to be used for shaft lining or where the shaft is sunk on an incline in the ore deposit; under other conditions round shafts are more advantageous. In the first place they are safer in bad ground; the difficult, tedious and costly cutting out of the corners is avoided; the walls are more secure and permit of equal pressure all around from the country rock, and also from water when waterproof lining is used. It is not necessary to discuss elliptical shafts because they do not offer the advantages that the round ones do. Polygonal shapes owe their existence to provisional timbering, previous to walling. While timber is considered the easiest to place, of the different kinds of lining, this is not always the case; in many places it is undoubtedly cheapest in first cost, that is to say, when no retimbering is necessary. In coal mines timber has its disadvantages on account of the fire danger and also because of the wreckage following an explosion, which makes rescue work almost impossible. In the Westfalien coal field, out of a total of 428 pits, 238 were circular in shape, 189 rectangular and one elliptical. In the potash industry of Germany all the shafts are circular and some of these must be numbered among the greatest achievements in shaft sinking.

SPEED OF SINKING

Leaving the inflow of water out of consideration, the speed of sinking a shaft depends on the time it takes to clean up after blasting. During the sinking of the No. 2 shaft at the Solvay works, in Germany, 100 m. of disturbed ground were passed through; the circular shape of the shaft permitted placing the end drills perpendicular and close to the walls of the shaft without doing these damage, and in this way the ground was always shot away toward the center, leaving the walls intact. With rectangular shafts this would not have been possible under similar circumstances, as the walls would have had to be straightened by the aid of picks.

There appears to be an idea that colliery shafts should be circular in form and ore-mine shafts rectangular. There is no adequate reason to confirm this. It is essential to give a shaft a certain security and durability with the lowest possible cost. While speed is a prime factor, nevertheless speed is in itself a saving. The question is, what system of sinking will fill these conditions?

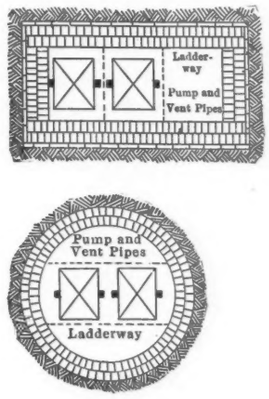

FIG. 1

KEEPING OUT WATER

As regards water-tight shafts, if any water-bearing strata are encountered after 70 m. depth, iron tubbing must be used, as no masonry can keep out water under a pressure of over seven atmospheres. The water will leak through any thickness of bricking. In this case the shaft must have a circular shape.

The advantage of shutting out water from a mine is obvious. This, however, can usually be done only where the mineral deposit is in the form of a seam, such as coal or salt. In the earlier days shafts were sunk with temporary lining to any depth, straight to the dry zone, and afterward were relined. Modern practice is to sink such a shaft in series, that is to say, sinking operations continue only to that point below any water-bearing strata where a wedge-crib or supporting wall can be placed successfully. After the temporary lining has been replaced with the permanent one, and the water thus shut out, sinking is again resumed until the shaft is below the next water inflow, and so on until the dry zone is reached. Several rectangular concrete shaft linings have been constructed in the United States, and the oval and elliptical forms are quite generally favored.

LESS EXCAVATION FOR CIRCULAR SHAFT

Circular shafts, although not as economical in speed, need less thickness of concrete and, therefore, less excavation. Reënforced concrete has clearly demonstrated its strength and cheapness for shaft lining in Upper Silesia; it has shown itself superior to ordinary masonry in resisting pressure, but inferior to it in keeping out water. The concrete linings are made behind 2-in. timber, and vary between 12 and 20 in. in thickness. While the first price of concrete is generally somewhat less than timber, it ultimately amounts to from 25 to 45 per cent. more because of the time necessary for placing.

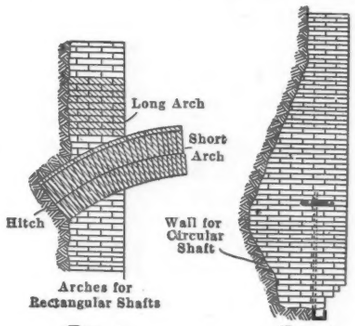

FIG. 2 FIG. 3

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CONCRETE NOT ALWAYS ADVISABLE

Concrete is not advisable for large shafts because it has to withstand hydrostatic pressure, which is not the case with the timber. The concrete should keep out the water completely, because "weep-holes" are not desirable. It should be remembered here that as yet experience regarding concrete as a lining is limited. In the lead-mining districts of Spain, where I have sunk many rectangular shafts, the methods were as follows: Where masonry is applied, the rock is cut away 0.6 m. outside the permanent size. At a suitable point four stone

arches, constituting a set, are put in and the walling is built up on them. For the short arches, hitches are hewn out of the rock. It is always advisable to place these sets of arches from 10 to 15m. apart, because of the lateral pressure. In a circular shaft, one supporting wall is sufficient for more than 50 m. of masonry. There is no danger from lateral pressure, because it is the same all around the lining. As a rule, only the upper part of the shaft is walled; the rest is fortified with timber, the frames being placed from 1 to 1½ m. apart. For this an extra 0.25 m. is given, reducing thereby the excavation. Masonry is usually more expensive than timbering and certainly is slower to construct, but a shaft once properly walled needs no repair. This cannot be said for timbering, however, especially in upcast shafts.

Cost of Retimbering

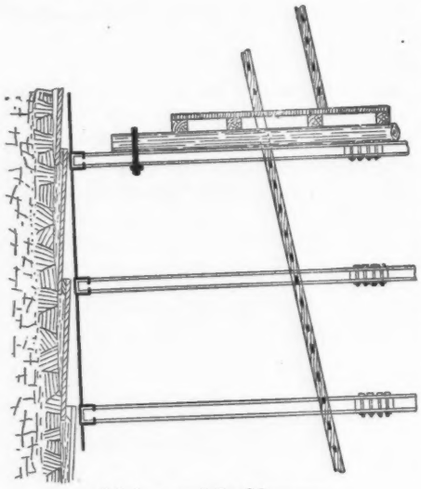
Retimbering of a shaft is often of more consequence than it appears at first sight. It is not only the cost of the new timber that must be taken into consideration, but also the taking out of the old material, which may be dangerous work and is apt to impede the regular traffic through the shaft, thus affecting the output of the mine. To what magnitude such an operation may eventually grow will be seen from the following details of Nos. 1 and 2 shafts of the Vereinsglück colliery. These pits had been sunk to 636 m. depth. They were rectangular in shape and timbered with frames 1 m. apart from 20 m. downward. No. 1 shaft took eight years to repair, and when No. 2 shaft was being overhauled, the remaining timber collapsed and the pit was blocked to within 260 m. of surface. The repairs of No. 2 pit lasted three years and three months, and cost over $50,000.

Mine owners who project only one hauling shaft should well consider the advisability of timbering. I agree that all mines should have two connections with surface, but it appears to me that mining companies are far too generous as regards shafts. For a mine say, with 200 tons crude ore output per 24 hours, one hauling shaft should be sufficient. In this shaft should be placed also the pump and ventilating pipes, ladderway, etc. Another small shaft connecting the permanent mine working with surface, would insure ventilation and a second outlet for the men. In a mine of this sort, it would not be advisable to have a timbered shaft, because any large repairs would probably cut down the output.

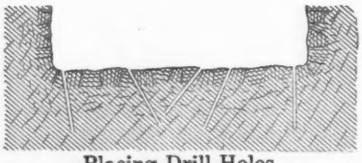
Shaft Linings

Some shafts which I have sunk in Spain have needed no lining at all, but even then it was tedious work breaking out the corners; however, the shape given permitted of an easy division of the compartment. It consisted in some cases of simply two-cage compartments and a ladderway, the guides being fixed to the dividers.

Under ordinary circumstances, the lining of circular shafts is simple. It consists, except where masonry is used, of U-shaped steel or iron rings placed at from 1 to 1½ m. apart, and held together by upright hooks. Boards are placed behind the rings and are held fast by wedges. The dividing pieces to hold the guides and ladderway are lashed to the rings. Each ring is made up of five segments. A good example of such work can be seen in the Kaiser Wilhelm II shaft at Clausthal, which is now down about 3000 ft. The iron work weighed 1225 kg. for each meter of shaft and



Lining and Ladderway for Circular Shafts.
Fig. 4



Placing Drill Holes Circular Shaft.
Fig. 5
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cost £15. During a period of 24 hr., 8 m. of shaft were lined, including the placing of boarding and cross pieces. A German expert has said that under similar conditions the speed of sinking a rectangular shaft would be much less. It is interesting to note that the lining described above is practically the same as that used for the provisional lining in the large collieries and salt mines on the Continent. I say "provisional" because walling or tubbing is always used when any fortifications are necessary.

Advantages of Rectangular Shafts

The advantages of a rectangular shaft are really few. Timbering is not practical in a circular form. Where timber is cheap and plentiful, and iron difficult to obtain, there can hardly be a question as to the shape of a shaft. The rectangular form adapts itself to the cage without loss of area. In circular shafts there is a loss of space between the squares formed by the cages and the circumference. In present practice, however, this space may be considered a necessary item as a means of conveying power cables and pump mains from underground to surface. This space is also used sometimes for ventilation.

Circular Form Cheaper and Safer

The advantages of the circular form are many and important. It is safer because of the pressure being equal in all directions. The lining can be considered a permanent one and cheaper in the long run and often in first cost, than timber. If boards are used behind the steel rings of the lining, they can easily be changed from time to time at little trouble and cost. Masonry is cheaper and easier because there is not the need of the repetition of hitches and arches. Less thickness of masonry gives equal strength. The speed of sinking is faster. The modern methods used in shaft operations to combat underground water and quicksand, such as the Kind-Chaudron and the Pötsch, with the aid of iron tubbing are all applied to the circular form of shaft.

Sinking Records Compared

Let us imagine that two shafts, one circular and one rectangular, are to be sunk to a depth of 200 m. in the rock that ore miners most commonly encounter, schist, and that the ground not being safe, lining is necessary. We will also assume that the district is in some not too remote part of Europe within measurable distance of a railway or shipping port. The inflow of water may be ignored because in this case it would make equal difficulties for both shafts. In these days of electrical pumps a large shaft can be avoided, and as the mine is not to be a large one, the dimensions given below will suffice.

DIMENSIONS OF CIRCULAR AND RECTANGULAR SHAFTS

Shape	Dimensions Inside, Meters	Area Finished Shaft, Square Meters	Area Temporary Shaft, Square Meters
Circular.....	3.00	7.06	12.57
Rectangular..	4x1.70	6.80	15.08

It has been decided to use walling to 100 m. depth. The masonry of the circular pit is 0.50 of a meter thick and that of the rectangular 0.60 m. The area of the latter shaft being larger than the former, more rock must be broken and extracted. Because of this and having to cut out the corners, the speed of sinking is considerably slower. At each meter, provisional pine sets with boards

behind are put in place in the rectangular shaft. At 50 m. depth, hitches are hewn out of the solid rock and a set of arches erected, upon which the masonry is built up. Arches are put in 10 m. apart because of the vertical and lateral pressure. Close repetition is necessary, as otherwise the masonry would be likely to bulge in. The arches are shown in Fig. 2. Another 50 m. are sunk and lined in the same way, thus arriving at the point where timber is to supersede masonry.

Blasting in Circular Shaft

The circular pit has also been sunk to 50 m. depth, where room for a supporting wall was hewn out of the rock. Upon this, the masonry has been built to surface. Such a supporting wall is shown in Fig. 3. Previous to walling, the shaft was fortified with steel U-shaped rings with boards wedged in behind. This provisional lining is taken away as the masonry advances. For the actual sinking, only one center plumb bob was necessary for aligning, and a rod cut to size gave the radius of the pit. The method of drilling the holes is given in Fig. 5. Great care was taken to let No. 1 shot go off first so as to make room for the No. 2 shots. The No. 3 shots were fired off after the mucking of the sump had been concluded. Progress of lining was faster than in the rectangular pit because only one supporting wall was needed and much less quantity of masonry. The sinking and lining from 50 to 100 m. depth were a repetition of that already described.

Timbering

In the rectangular shaft from 100 m. downward permanent pitch pine 8x8-in. sets were put in 1 m. apart, each corner being held up by a column. To guard against falling stones, boards were wedged in behind the sets, care being taken to fill up all open spaces. Below the walling in the round shaft, U-shaped steel rings were placed 1 m. apart. These were held together by hooks, and boards were put in behind the ring and securely wedged in. This class of permanent lining is made speedily as has elsewhere been observed. In Fig. 4 it will be noticed that each ring is made up of segments and hooked on to the one above, thus allowing of no movement.

It is convenient to use cables for guides, and not to place the permanent 4½x4½-in. pitch pine until the sinking operations are concluded. Considerable time is gained in this way and the guides are new when the pit is opened for regular traffic. If we except the boards, which are easily replaced, the circular shaft has a permanent lining, whereas the rectangular one may have to be retimbered in a few years. As regards speed and cost of sinking, I leave the reader to decide for himself. These examples do not deal with shaft sinking under difficult circumstances, because such operations are confined chiefly to circular pits and are often enough quite impossible in a rectangular one.

Yessenitz Shaft, North Germany

Many such examples could be given, the most notable of which is the Yessenitz shaft in North Germany. It took 21 years to sink. The operations were continued with unprecedented perseverance against an accumulation of difficulties of every description. The Pötsch system of freezing the quicksand into solid blocks of ice was successfully carried out to a depth of 75 m. From 75 to 130 m. the shaft was sunk by hand, but on account of the enormous quantity of water, the freezing system and great pumping installations failed to attain a depth of 150 m. Ten years passed in this way. Ultimately, the shaft was successfully bored by the Kind-Chaudron method. A number of shafts have been treated similarly when every other way has failed or left no prospect of success. In shaft sinking, where large quantities of water are expected, it is well to consider that eventually boring may become necessary and to arrange the shaft and operations favorably for this.

To return to the question at the beginning of this article, "why certain districts characterized by similar conditions adhere so strongly to one particular type of shaft," I think I am justified in answering that it is a matter of custom. With all due respect to metal miners, I think more knowledge of circular shaft sinking would result in a benefit to shareholders in many mining concerns.

The Utilization of Tin Scrap

The utilization of old tin cans by detinning at the works of the London Electron Works Co. Ltd., appears to have attained the figure of 20,000 tons per annum[1]. The process consists in unloading the cans on a shaking conveyer, which frees them from readily detachable dirt. This is also used as a picking belt, only tinned scrap being allowed to enter the works. The cans then go through a series of drums, in which they are crushed, perforated and heated. In the last all extraneous matter, including solder, is removed. The cans are then pressed into briquets ready for the detinning process. In chronicling the success of the London Electron plant, exception is taken to a recent article in the Journal[2] on the subject of tin-plate scrap, in which the backwardness of old-can treatment was lamented. It appears, however, that even in thickly settled England one of our own inhibiting factors has some force, since we are told that, owing to the high rates of the railroad companies, "many sources of supply are not even tapped as yet."

So far, in the United States, conditions of distance and of wages have operated to render detinning of old cans more or less unprofitable, unless the new dry-chlorine process has furnished what has long been hoped for: A process so good as to overcome these inherent disadvantages and give us a new industry which can still support highly paid labor.

[1]Iron and Steel Trades Journ., Nov. 25, 1911.

[2]Eng. and Min. Journ., Oct. 7, 1911.

Selenium and Tellurium

The sources of supply of the element selenium continue to be the residues of the electrolytic-copper refineries, and the flue dusts of acid chambers. The uses are limited and none of the copper refineries is probably producing up to its capacity. It is used in making the best quality of red glass, such as that for railroad-signal lights, in which the red must be clear, with no hint of green. It is also reputed to be used in producing the yellowish-brown glazes on certain potteries.

It is the only metal known of which the electric conductivity varies with exposure to light, the metal being about 500 times as good a conductor in the light as in the dark. For this reason it is used in several automatic gas-lighting apparatus, and is also used in the experimental devices for transmitting pictures by wire, and for wireless telephony along a beam of light. However, at no time is its conductivity good, and usually a great surface of the metal is used, spread out on a glass plate or other nonconducting surface. There are several allotropic forms of the metal, and the change from vitreous to metallic selenium is attended by a great evolution of heat. This change takes place in a bar which remains warm for some time, so that in casting large vitreous bars they must be cooled rapidly; otherwise, sometimes even after the bar has apparently set and can be picked up, it undergoes recalescence, becomes too hot to hold and changes to the metallic form. The reverse change requires remelting and quick cooling.

Tellurium continues to find its uses as a chemical curiosity, as a component of certain high-resistance alloys and, theoretically, as an antisudorific agent in medicine, but the "garlic breath" following its administration makes its use more honored in the breach than the observance. The price is high, about $1 per oz., and the processes for its recovery from copper slime are unsatisfactory, and it is difficult to tell at which end to begin, whether to find uses first and strive to develop the process, or find a good process and develop the uses, but it is unlikely that the last will be done, as it is probable that it would limit the use of selenium to extend that of tellurium.

Composition of Explosives

The report of the chief inspector of explosives in Western Australia gives some interesting figures on the composition and properties of the various explosives used in mines. In 20 samples of various brands of gelignite, gelatin dynamite and blasting gelatin, three were found to be theoretically underoxidized, the greatest deficiency being 1.47 per cent. of oxygen. In those which were theoretically overoxidized, the highest excess of oxygen was 6.13 per cent. When the paper wrappers were taken into account in the calculations, eleven of the explosives were found to be underoxidized, the greatest deficiency being 3.63 per cent.

Determinations of the velocity of detonation were made, the lowest figure obtained being 1708 m. per sec. for one of the gelignites and 4100 m. per sec. for one of the blasting gelatins. The view is advanced that in gelatinized nitroglycerin explosives containing collodion cotton, sensitiveness to detonation is due to free nitroglycerin distributed throughout the mass of the explosive, in intimate contact with the main mass of colloidal mixture of collodion cotton and nitroglycerin. It is considered possible that this nitroglycerin is slowly absorbed into the mass of colloid, and there exerts its power of solution upon particles of collodion cotton not completely dissolved, and that when this absorption takes place the explosive becomes less plastic and less sensitive.

The general experience in Western Australia is that an explosive which, on landing from Europe, is soft and plastic, will, after a lengthy storage in the magazine, become stiff and more rigid to touch, while the common experience is that such explosives explode only under excessive stimulus, and are apt to leave unexploded portions in the bottoms of the bore holes in mines. When an increase in inertness takes place it is further often accompanied by fall of heat test and it is suggested as an explanation of this that an extended solution of collodion cotton, due to the further absorption of nitroglycerin, liberates small quantities of acids from the fibers of the collodion cotton which have not been extracted by washing in the factory. The heat tests immediately after manufacture are higher than those obtained when the explosive is landed in Australia, and although the voyage through the tropics has been advanced as a possible explanation of this, no physical change has been given as a possible key to the series of phenomena observed.

Empire Tailing Elevator

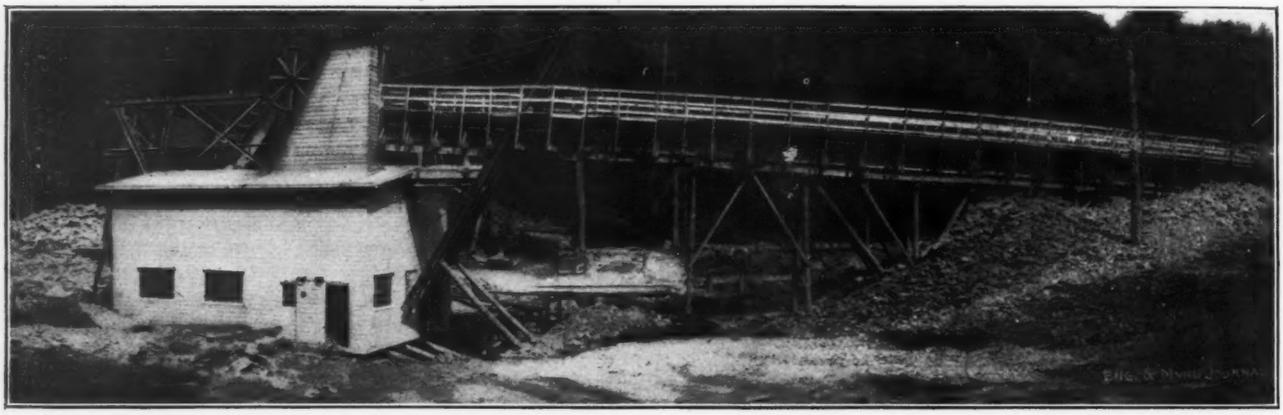
Many placer deposits are too flat or have insufficient water for successful hydraulic mining; many contain boulders too large or the bedrock is too hard and rough for dredging. To meet the difficulties in hydraulic mining where there is insufficient water or where the grade for sluices and the dump for tailings is limited, the Empire mechanical tailing elevator has been designed.

This elevator consists of a chain of dredge buckets running over upper and lower tumblers and driven from the upper one. These buckets are mounted on a ladder, the outer end of which is raised and lowered in the same manner as in gold dredges. The whole is mounted upon a car which operates on wheels or rollers as the necessity arises.

Briefly, the operation is as follows: Gravel is hydraulicked in the usual manner through a ground sluice to a sump at the base and in front of the elevator. The buckets pick up the material from this sump and elevate it to a sufficient height and dump it into the sluice of the elevator.

This material is then washed down through the sluice and discharged at its end, which is at a sufficient height above bedrock to provide ample dump for the tailings. This sluice is paved with riffles for the recovery of any gold that has not been caught in the ground sluice in front of and leading to the elevator.

The elevator may be steam, electrically or hydraulically driven. A centrifugal pumping plant mounted on the car lifts sufficient water from the sump to the upper sluice to wash all the material through the sluiceway. After the bank is hydraulicked or washed away, the elevator is moved toward the bank. To facilitate the moving, the whole apparatus is mounted on wheels and is provided with a power winch by means of which the digging end of the ladder with its line of buckets is raised from the sump. After the elevator has been moved forward the end of the ladder is lowered and the buckets assist in digging the sump. The elevator does the work of a hydraulic elevator with greater certainty and with a smaller percentage of water. Other advantages claimed for this hydraulic elevator are: It operates on a substantial foundation (bedrock). It is self-contained and is readily moved when necessary, requiring no elaborate preparation or changing of pipe lines; it requires little attention while running, especially if it is electrically driven, which does away with the handling of fuel. One man is all that is necessary to operate it.



EMPIRE TAILING ELEVATOR OPERATING IN BEAUCE COUNTY, QUE.

New Pittsburgh Blast Furnaces

For more than a year the Pittsburgh Steel Co., operating an openhearth steel plant and rod, wire and wire-nail mills, at Monessen, Penn., has had under consideration the erection of blast furnaces to supply basic pig iron for the steel works. Plans for three blast furnaces have recently been completed by Julian Kenedy, and contracts for two awarded to the Garrett-Cromwell Engineering Co. It is also the intention of the company to add four 60-ton openhearth steel furnaces, making a total of sixteen 60-ton furnaces, with a capacity of close to 2000 tons of steel per day. F. N. H. Gerwig, formerly of the Carrie furnaces of the Carnegie Steel Co., at Rankin, Penn., has resigned to become blast-furnace superintendent for the Pittsburgh Steel Company.

Carnotite in Paradox Valley, Colo.

By Thomas F. V. Curran*

Description of the carnotite deposits in southwestern Colorado which are being developed for their vanadium and uranium contents; some of these ores are radioactive.

*President, General Vanadium Co., 1502 Continental Building, Baltimore, Md.

Carnotite is the lodestone drawing attention to the Paradox Valley in southwestern Colorado. Nor could fortune beckon more luringly, for carnotite is the word-shell of the triple treasures radium, vanadium and uranium. Nestling west of the Uncompahgre plateau in Montrose County, the valley for the greater part is at right angles with the course of the Dolores River which flows along its western border, hence the name Paradox. Its eastern entrance is at Dry Creek, six miles west of the hamlet Naturita and 46 miles west of the nearest railway station, Placerville.

Paradox Valley is seen from the tablelands around Norwood and Redvale as a void between gigantic saw-tooth ranges running westerly until they merge into the bisecting Lascal Mountains. It is three miles wide and over 50 miles long, and as a whole, is an expanse of sandy loam, dry and dusty most of the year but yielding abundant crops when favored with the infrequent rains. As yet it has no irrigation. On the north and the south the valley is bounded by mesas having a mean elevation over the valley of about 1200 feet.

Orebodies of Blanket Form

The carnotite orebodies outcrop from the sloping sides of the mesas about 600 ft. above the valley's level. These orebodies are in blanket form, varying in thickness from 12 to 40 in. The ore may be mined much like the Pennsylvania bituminous coal beds are worked, by horizontal tunnels driven in from the surface. The ore is roughly sorted and placed in canvas sacks holding about 85 lb. each and is hauled by wagon to Placerville over a stage road, which is in fairly good condition during the dry season, at a haulage cost of $18 per ton.

Placerville is about 7000 ft. above sea level and is important, notwithstanding its population of only 350, for it is the distributing point of over 3000 square miles of country and from it are shipped thousands of fat cattle and quantities of vanadate of iron, the latter reduced from its roscoelite sandstones, at the nearby village, Vanadium.

On the road from Placerville to the Paradox, the ranch-town Norwood is 18 miles west, thence 5 miles is Redvale, which boasts an interesting weekly paper. The soil is fertile and well irrigated and gives bountiful crops of alfalfa, oats, barley and wheat. Forty miles from Placerville is Naturita, which is, as its name implies, a veritable and delicious touch of nature. Through it dashes the San Miguel River at a normal flow of seven miles an hour. The stage road follows the river for about three miles west of Naturita, and then swings at right angles along Dry Creek and over the hills at the coke ovens, where there are deposits of good bituminous coal, down into the Paradox Valley.

In the East Paradox Valley there are no streams; the sun's rays are unrestrained by clouds, and the alkali dust is carried along the stage road in blinding swirls. With mystic and determined hope, a few families have taken up homesteads and yearly wait for the completion of the irrigation project that is to convert this desert into a paradise.

Jodandy Mine Best Known

The mine best known in the Paradox is the Jodandy; it is 12 miles west of Naturita and has an elevation of about 6000 ft. above sea level. On an eminence below the main tunnel is a permanent camp, with an office and complete laboratory. The ores are of variegated colors and richness, from vivid canary yellow with from 10 to 15 per cent. uranium oxide, to the somber greenish black Kentsmithite, or the red hydro-calcium vanadate having as much as 90 per cent. vanadium oxide. It is the center of a group consisting of the Susquehanna, Valley View, Blackburn, Johnny C., Good Luck, Hummer, Broker, Simplon, Yellow Bird. Fifteen exploration tunnels and numerous opencuts have been made, and from here over a thousand tons of ore have been shipped. The ore outcrop can be followed along the surface contour and has been uncovered almost two miles. The operations afford cumulative daily proof of the permanency, great volume and richness of these deposits.

The Thunderbolt group of lode claims is on the same, or southern, side of the valley, and about two miles east of the Jodandy. The ore is similar in nature, content and quantity. One of the tunnels here has been driven 150 ft. in excellent shipping ore. Below this tunnel is Camp Hequembourg, established a year ago, with offices, telephone connections, laboratory, etc. The camp employs a force of 40 miners in mining and development work.

Immediately to the west of the Jodandy is the Monogram group and camp, employing from 35 to 40 men, and operated by the Thunderbolt owners. The original Monogram lode is about exhausted, and was evidently a slide from a long wide bench 250 ft. above it. In this bench are the Anna May, A No. 1, Black Diamond, Wilson, Little Tom, Happy Thought, Holiday, Junita, Great Hesper, Greenback, Gray and Sunnyside, which are handsomely repaying the work expended on them. A unique feature of the Anna May is a 35-ft. exploration shaft by means of which the carnotite vein, three feet thick, was discovered. Camps Hequembourg and Monogram each are favored with a large spring of clear, cold water.

To the east of this bench group are the Acoma and Opera Box lodes; the latter is picturesque, appearing from the valley as an immense opera box in the sheer walls of the rocky cliffs. The carnotite ore veins here are so unmistakably in place as to have offered the first nature lesson in refutation of the theory that carnotite deposits are mere surface pockets.

Many Claims in Bull Cañon

Bull Cañon lies four miles to the south. It is, in fact, a series of cañons, 15 miles in length, the southwestern part being in San Miguel County, and is bounded on the west by the Dolores River, which slowly wends its serpentine course northward. A lone cabin belonging to an Indian miner and rancher, Henry Huff, is in the cañon nearest the deposits last named. East of the cabin and about 600 ft. above it is a bench which shows a continuous blanket of carnotite ore covered only by a sandstone cap not over a foot thick in places; the lode claims here are known as the Little Joe, Rosebud, Lookout and Sunday. Scattered through the cañons are the Sundown, Saunders, Gingle, Buttermilk, Old Mexico, New Mexico, Uranium Belle, Cabin, Huff, Ibex, Rainbow and Wedding Bell lodes, many of which look as though they will be good ore producers. A wagon road connecting Redvale with the cañon can be built at small cost.

Still further south, near Cedar, is the McIntyre district, where 10 or 12 good claims are being worked and a large camp has recently been established. In the northern mesa, or tableland, of East Paradox Valley is Long Park, where many fine claims are being worked. Here, in Saucer Basin, is the Cliff claim, from which three carloads of carnotite, averaging 6 per cent. uranium oxide, were extracted during the last few months. The present exposure shows the claim to have a large mass of high-grade ore.

Near-by is the Sweadler, or Swindler, lode, from which a carload of ore equally rich was mined by two men during the last month. It is predicted that this lode will yield fully 2500 tons of shipping ore.

The Copper Prince Mine

At the western end of East Paradox Valley, on the Dolores River, is the hamlet Bedrock; the valley now swings abruptly toward the north, and this northern stretch is called the West Paradox Valley. Eighteen or 20 miles north of Bedrock is Paradox, a small town. Close to it is the Copper Prince mine, said to contain a fissure vein of carnotite. More than a decade ago, agents of Doctor and Madame Curie operated this mine and a small factory at Uranium. Over 400 tons of carnotite averaging 10 per cent. uranium oxide were taken from the mine, which was abandoned owing to the failure of the extracting process employed. The Copper Prince is on the side of a steep hill and has a shaft about 350 ft. deep. Three levels were run from the shaft to the surface, the first about 100 ft. long, the next 200 ft. and the deepest 300 ft., and all these levels are said to be in ore. It is suggested that the solutions from the upper carnotite strata gravitated into a vertical cleft in the rocks and that the shaft is not in a fissure vein. Quite a number of other carnotite ore claims are being operated in this vicinity; much of the ore contains 10 to 12 per cent. copper.

Ten miles southeast of Paradox is a sheltered valley housing an important cattle ranch, known as the Club ranch. In this vicinity is an abandoned placer mine, that had hydraulic machinery, etc., costing a half-million dollars, and the district is called Hydraulic. On the sloping hillsides and benches are the carnotite lode claims Club, North Star, Paradox Bell, Maggie C., Little Basin, Wright, Ruth Ellen, Tabequache, Old Salt Lick, Valentine, Blackbird, Bluebird, Big Dick, Little Dick, Ranch View, Truscott and B & M, showing well in richness and volume. Through the valley here flows the San Miguel River, which empties into the Dolores a few miles further north.

About 10 miles west of Paradox postoffice is the Yellow Bird group of claims, situated along La Sal Creek. The country here is generally exceedingly broken, and only superficial work has been done. Ore from two holes gave 3 per cent. vanadium and 2 per cent. uranium. Four miles beyond are the Kent and Bonanza claims, which show much better; in one a tunnel 65 ft. long was driven in a 3-ft. vein of shipping ore. From this on through Sinbad Valley, with its ores of combined copper, vanadium and uranium, through Unaweep Valley, through Richardson to Cisco, Utah, on the Rio Grande Western Ry., is a belt of carnotite ore that has been prospected but little.

This hasty sketch only hints at the resources of the Paradox. The prospector has simply scratched the surface, here and there, and when the work is done properly, and the district has adequate transportation facilities, it promises to be one of the greatest mining centers of this country. A survey has been made of an automobile-truck road with a moderate grade, connecting the Paradox with Grand Junction, and active steps are being taken to build another road to Montrose.

Ore Shipped to Pennsylvania and England

The demand for carnotite ore, as a source of vanadium employed in medicine, dyeing and improving iron, steel and copper; of uranium salts for tinting, etc.; and for the extraction of radium, is increasing rapidly. It is universally conceded that vanadium toughens and strengthens the metal in which it is incorporated. Armor and protective deck plates, propellers and crankshafts, machinery parts, locomotive frames and other castings—in short, all metal requiring great resistance to shock and vibration, with high degree of strength and durability—are greatly improved by vanadium. Fully 90 per cent. of the present carnotite ore production is shipped to either Liverpool, England, or to Canonsburg, Penn. At the latter place it is converted into radio-active materials.

From a manufacturing standpoint, carnotite is the most desirable of all ores, for its content is cheaply and quickly extracted and with simple and inexpensive plant equipment. In a solution containing 10% sulphuric acid, 86% of the vanadium content may be extracted in 15 min. and the whole of the vanadium content in one-half hour. Henceforth much of the future of both the radium and the vanadium industries will be interwoven in the story of the development of the carnotite orebodies of western Colorado.

Removal of Metalloids from Lead Alloys

A process for the removal of arsenic from lead alloys, without affecting the antimony content, has lately been patented (U. S. pat. No. 1,006,323) by Leland E. Wemple, of the Hoyt Metal Co. This consists in an apparatus in which lead is melted in an upper kettle and allowed to fall drop by drop or in a small stream into a second kettle containing molten caustic soda or potash, the former being cheaper than, and as effective as the latter. The second kettle is trapped, and as the lead slowly passes through and under the caustic alkali, the arsenic is absorbed. From this kettle the alloy flows into a kettle of the ordinary sort, from which it is cast as usual. After a time the alkali becomes saturated with arsenic and must be replaced.

In order that the antimony or tin contents may not be affected the inventor provides that certain reducing, or as he styles them, retarding agents, be used, such as zinc dust, iron scale or iron filings, or aluminum powder, preferably about 20 parts of iron scale to 100 parts of alkaline hydroxide. The use of the alkaline hydroxide bath without any other reagent affects antimony and tin to some extent, but if complete removal of tin, antimony and lead is desired, an intensifying agent is added, such as sulphur, or sodium nitrate, chlorate or peroxide.

To remove any traces of the refining mixture, the lead in the final casting kettle is treated with a small amount of salt-cake, the resultant scum or dross being skimmed off.

Placer Prospecting in Colombia

Special Correspondence

Much activity in prospecting dredging ground with Empire drills has been done lately in the Miel-Samaná region. The bedrock consists of sandstone with a soft capping from 1½ to 2 ft. thick. The drill holes vary from 34 to 56 ft. in depth and are spaced about 50 ft. apart. To a depth of 20 ft. the gravel runs about 15c. per cu.yd., and the pay streak, from 12 to 15 ft., runs about 65c., increasing in grade upstream.

Satisfactory explorations have been made near Cucharo, below Samaná Cañon, where nuggets worth $60 were found at a depth of about 9 ft. P. A. Alig, who has options on 67 claims, 5000 x2000 m. each, is making a survey of the Samaná, San Juan, Miel and Rio Clara regions.

Investigations on the entire zone have begun and up to the present have been satisfactory in most cases. In February, it is expected that a line of holes will be sunk on both sides of the river near Cucharo, 1000 m. below the cañon. Ground sluicing has been commenced on a large scale on the Rosario, a tributary of the Samaná. Coarse gold has been found and the gravel averages from 80c. to $1 per yd. To secure an outlet from the San Antonio portion of the Rosario mine, a tunnel about 200 ft. long will be driven. This is an ancient lake deposit and the ground averages about $2 per yd. Alexander von Humboldt refers to these deposits in his memoirs of South America. W. J. McNamara, of California, is in charge of this work. Climatic conditions are good, miners and natives enjoying good health as long as they keep away from fried foods and liquors. Transportation facilities on the Miel River are good, the average depth of water being from 6 to 7 ft., with a current of from three to six miles per hour.

Mining and Metallurgical Patents

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

A Classified List of New Inventions

COPPER

BRADLEY PROCESS — Method of Treating Copper-bearing Substances. Charles S. Bradley, New York, N. Y., assignor to Bradley Copper Process Co., Jersey City, N. J. (U. S. No. 1,011,562; Dec. 12, 1911.)

CONVERTER TUYERE. Elias A. C. Smith, Baltimore, Md., assignor to Peirce-Smith Converter Co. (U. S. No. 1,007,149; Oct. 31, 1911.)

LEACHING—Process for Extracting Metals from Their Ores. Henry S. MacKay, Riverside, Calif., assignor to MacKay Copper Process Co., Riverside, Calif. (U. S. No. 1,011,459; Dec. 12, 1911.)

GOLD AND SILVER

CYANIDING—Apparatus for Treating Crushed-ore Products for the Recovery of the Metal Contents Thereof. Alexander John Arbuckle, Johannesburg, Transvaal. (U. S. No. 1,008,513; Nov. 14, 1911.)

CYANIDING — Means for Separating Liquids from Crusher-ore Products. William Arthur Caldecott, Johannesburg, Transvaal. (U. S. No. 1,008,524; Nov. 14, 1911.)

CYANIDING—Process for Precipitating Hydro-metallurgical Solutions by Means of an Improved Precipitant. Charles W. Merrill, Berkeley, Calif. (U. S. No. 1,006,865 and 1,006,866; Oct. 24. 1911.)

CYANIDING—Process of Treating Metalliferous Ores. John Collins Clancy, New York, N. Y. (U. S. No. 1,010,347; Nov. 28, 1911.)

DREDGES—Float for Dredges. Harry J. Barnhart and Harvey T. Gracely, Marion, Ohio, to Marion Steam Shovel Co., Marion, Ohio. (U. S. No. 1,010,568; Dec. 5, 1911.)

ELECTRICAL PRECIPITATOR AND AMALGAMATOR. John Frey, San Francisco, Calif. (U. S. No. 1,009,143; Nov. 21, 1911.)

ORE TREATMENT—Process of Treatment of Ores for Recovering Metal Values Therefrom. Henry W. Kent, Milwaukee, Wis., assignor to Kent Ore Reduction Co., Chicago, Ill. (U. S. No. 1,009,906; Nov. 28, 1911.)

PLACER-MINING APPARATUS. Vivian V. Clark, Seattle, Wash., assignor to Northern Engineering Co., Seattle, Wash. (U. S. No. 1,011,321; Dec. 12, 1911.)

STAMP-MILL SCREEN. Darius Comstock En Earl, Rollinsville, Colo. (U. S. No. 1,008,804; Nov. 14, 1911.)

IRON AND STEEL

BLAST FURNACE. Charles Francis Jenkins, Washington, D. C. (U. S. No. 1,010,265; Nov. 28, 1'11.)

BLAST FURNACES—Sight for Blast Furnaces. Thomas M. Cunningham, Reading, Penn. (U. S. No. 1,010,120; Nov. 28, 1911.)

CONVERTERS—Method of Preparing Bottoms for Thomas Converters. Ernest Jules Planche, Paris, France, assignor to Société Anonyme des Forges et Fonderies de Montataire, Paris, France. (U. S. No. 1,010,312; Nov. 28, 1911.)

DIRECT PRODUCTION—Improvements in Connection with Furnaces for the Direct Production of Iron and Steel from Iron Ores. W. S. Simpson and H. Oviatt, London, Eng. (Brit. No. 18,679 of 1910.)

EXTRACTION—Improvements in a Process of Extracting Iron from Its Ores. S. G. Martin, Chicago, Ill. (Brit. No. 24,052 of 1910.)

PURE IRON—Method of Producing Practically Pure Iron. Archibald Smith, Tarentum, Penn., assignor to the Allegheny Steel Co. (U. S. No. 1,008,377; Nov. 14, 1911.)

RUSTING—Treatment of Iron or Steel to Prevent the Oxidation or Rusting Thereof. Thomas Watts Coslett, Birmingham, England. (U. S. No. 1,007,069; Oct. 31, 1911.)

SLAG—Process of Accelerating the Elimination of Occluded Slag from Molten Metal. Robert Lock, Tarentum, Penn. (U. S. No. 1,008,420; Nov. 14, 1911.)

LEAD AND ZINC

LEAD—Process of Making Lead Salts. Louis S. Hughes, Joplin, Mo., assignor of one-half to himself and one-half to Picher Lead Co., Joplin, Mo. (U. S. No. 1,008,412; Nov. 14, 1911.)

ZINC—Extraction of Metals from Their Ores. Woldemar Hommel and Henry Thomas Durant, London, England, assignors to Metals Extraction Corporation, Limited, London, England. (U. S. No. 1,009,750; Nov. 28, 1911.)

ZINC—Furnace for Extracting Zinc. Otto Schneemilch, Wilhelminenhütte, near Schoppinitz, Germany. (U. S. No. 1,009,863; Nov. 28, 1911.)

ZINC—Improvements in and Relating to the Production of Zinc and Other Metals. A. B. Pescatore, London, Eng. (Brit. No. 29,839 of 1910.)

ZINC—Improvements in or Relating to Zinc Distillation. J. C. Moulder and H. W. Webster, Durham, Eng. (Brit. No. 26,788 of 1910.)

ZINC—Smelting Process for Low-Grade Ores. Edward Dedolph, Kaslo, B. C., Can. (Brit. No. 24,009 of 1910.)

NONMETALLIC MINERALS

ASBESTOS SEPARATOR. Frederick S. McKay, Sherbrooke, Que., Canada, assignor of one-fourth to James H. Bury, Casper, Wyo. (U. S. No. 1,010,779; Dec 5, 1911.)

SULPHUR—Mining Sulphur. Herman Frasch, New York, N. Y., assignor to Frasch Sulphur Process Co. (U. S. No. 1,008,319; Nov. 14, 1911.)

MINING—GENERAL

CABLEWAYS—Grip for Cableways. Samuel S. Webber, Trenton, N. J., assignor to Trenton Iron Co., Trenton, N. J. (U. S. No. 1,010,535; Dec. 12, 1911.)

CANDLESTICK—Miner's Folding Candlestick. Nathan E. Varney, Denver, Colo. (U. S. No. 1,011,878; Dec. 12, 1911.)

DRILLING — Core-Lifting Appliance for Drills. Lester Christopher Harden and Frank Wildeson, Kimberly, Calif. (U. S. No. 1,008,904; Nov. 14, 1911.)

DRILLING—Improvements in Chucks or Tool Holders for Rock-Drilling Machines. E. J. Rule, Redruth, Cornwall, and J. Ferguson, High Whycombe, Eng. (Brit. No. 3271 of 1911.)

DRILLING — Shell for Rock-Drilling Machines. Lewis C. Bayles, Johannesburg, Transvaal, assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,009,376; Nov. 21, 1911.)

DRILLS—Rotation Device for Drills. Charles C. Hansen, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,009,301; Nov. 21, 1911.)

DRILLS—Valve Motion for Rock Drills. Lewis Condict Bayles, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 13,317; Nov. 21, 1911.)

FUSE—Electrical Safety Fuse. Georg Müller, Schwäbisch-Gmünd, Germany. (U. S. No. 1,010,232; Dec. 12, 1911.)

MINE CAR. Thomas Donohoe, Edgewood Park, Penn. (U. S. No. 1,010,738; Dec. 5, 1911.)

PUMPS—Method of Operating Internal-Combustion Pumps and Compressors. Henry M. Chance and Thomas M. Chance, Philadelphia, Penn. (U. S. No. 1,011,410; Dec. 12, 1911.)

SAFETY LAMP. Georg Alfred Wiede, Weissenborn, near Zwickau, Germany. (U. S. No. 1,011,543; Dec. 12, 1911.)

SHAFT LINING—Lining for Shafts. William T. McCarthy, Crosby, Minn. (U. S. No. 1,008,727; Nov. 14, 1911.)

TUNNEL - EXCAVATING MACHINE John Nels Back, Seattle, Wash. (U. S No. 1,011,712; Dec. 12, 1911.)

TUNNEL FORM. Charles D. McArthur Pittsburg, Penn., assignor to Blaw Collapsible Steel Centering Co., Pittsburg, Penn. (U. S. No. 1,009,848; Nov. 28, 1911.)

WIRE ROPE. George Walton Wetsgarth, Cardiff, England. (U. S. No. 1,011,687; Dec. 12, 1911.)

ORE DRESSING—GENERAL

AGITATING AND CLASSIFYING DEVICE. Jason W. Fairfield, Goldfield, Nev. (U. S. No. 1,010,244; Nov. 28, 1911.)

CONCENTRATING TRAP. George Gundaker, Meaderville, Mont., assignor of one-half to himself and one-half to Antone C. Grosso, Meaderville, Mont. (U. S. No. 1,005,828; Oct. 17, 1911.)

CONCENTRATION — Improvements in or Relating to Ore Concentration. Henry Lavers, Broken Hill, N. S. W., Minerals Separation, Ltd., and E. H. Nutter, London, Eng. (Brit. No. 23,870 of 1910.)

CONCENTRATION — Improvements in or Relating to the Concentration of Ores. H. H. Greenway, Melbourne, Aust., and Henry Lavers, Broken Hill, N. S. W. (Brit. No. 22,973 of 1910.)

CONCENTRATION—Mechanical Movement for Ore Concentrating and Separating Apparatus. Francois Dallemagne, Pasajes, Spain. (U. S. No. 1,006,831; Oct. 24, 1911.)

CRUSHING—Chilian Mill. Alexander J. McCone, Reno, Nev. (U. S. No. 1,008,046; Nov. 7, 1911.)

CRUSHING HEAD for Ore and Rock Crushers. Harry A. Hunt, Glen Gardner, N. J., assignor to Taylor Iron & Steel Co., High Bridge, N. J. (U. S. No. 1,009,520; Nov. 21, 1911.)

IMPROVEMENTS in Ore Dressing. G. T. Holloway, London, Eng. (Brit. No. 26,262 of 1910.)

JIGS—Indicating Mechanism for Jigs or Classifiers. Frank D. Baker, Denver, Colo. (U. S. No. 1,011,307; Dec. 12, 1911.)

SCREEN—Ore Screen. Enos A. Wall, Salt Lake City, Utah. (U. S. No. 1,005,907; Oct. 17, 1911.)

SEPARATOR—Centrifugal Ore Separator. Philip F. Peck, Chicago, Ill. (U. S. No. 1,011,077, and 1,011,078; Dec. 5, 1911.)

SLIME CONCENTRATOR. William F. Deistér, Fort Wayne, Ind. (U. S. No. 1,010,350; Nov. 28, 1911.)

METALLURGY—GENERAL

ASSAYING—Apparatus for Assaying Ore. Benjamin Fulton Gardner, Chicago, Ill. (U. S. No. 1,009,660; Nov. 21, 1911.)

CALCAREOUS ORES — Improvements in and Relating to the Treatment of Calcareous Ores. Hermann Schwabacher, London, Eng. (Brit. No. 25,030 of 1910.)

OIL-BURNING FURNACES—Air-Regulating Device for Oil-Burning Furnaces. Knut M. Dahl, San Francisco, Calif., assignor to Union Iron Works Co., San Francisco, Calif. (U. S. No. 1,009,723; Nov. 28, 1911.)

REDUCTION — Method of Reducing Ores. Otto Frick, Stockholm, Sweden. (U. S. No. 1,010,490; Dec. 5, 1911.)

ROASTING — Improvements in Ore-Roasting Furnaces. Thomas Edwards, Ballarat, Victoria, Australia. (Brit. No. 23,565 of 1910.)

ROASTING — Ore-Roasting Furnace. Thomas Edwards, Ballarat, Victoria, Australia. (U. S. No. 1,008,892; Nov. 14, 1911.)

SMELTER—Fume-Destroying Composition. Stewart W. Young, Palo Alto, Calif., assignor to Globe Chemical Works, San Francisco, Calif. (U. S. Nos. 1,007,409; Oct. 31, 1911, and 1,011,699; Dec. 12, 1911.)

SMELTER SMOKE — Dust Arrester. John H. Gamblin, Riverside, Calif. (U. S. No. 1,009,963; Nov. 28, 1911.)

SMELTER-SMOKE WASHER. William Gould Bulgin, Franklin, N. C. (U. S. No. 1,011,025; Dec. 5, 1911.)

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

J. P. Hutchins is at St. Petersburg, Russia.

T. Lane Carter, of Chicago, has been visiting New York.

E. D. McDermott is sampling gold mines in Nicaragua.

Ralph T. Hirsh has returned to New York from southwestern Alaska.

R. E. Smith is examining platiniferous alluvium, near Ekaterinburg, Russia.

Robert H. Richards has just returned from a professional trip to Wilmington, Delaware.

A. A. Hassan has left Cobalt, Ont., and will be in Brooklyn, N. Y., for several weeks.

D. C. Jackling, of Salt Lake City, Utah, has been inspecting the Ray and Chino mills in Arizona.

Mark L. Requa returned to San Francisco from the East recently and left Dec. 14 for Arizona.

A. O. Hoffmann has left Polevskoy, Russia, for a professional business trip to Stockholm, Sweden.

William Knox has arrived in London from Vladivostok, Siberia, where he has been engaged in drilling placer ground.

Edwin J. Collins, of Duluth, Minn., sailed from New York this week on a six weeks' examination trip to the West Indies.

H. L. Slosson, Jr., recently elected president of the Mexican Mining Co., is at Virginia City, Nev., inspecting the property.

Alexander Leggat recently left Butte, Mont., for the Jena tungsten mine, at Patterson Creek, Idaho, on professional business.

R. C. Canby is in the Southwest on a metallurgical investigation. Mr. Canby will make his headquarters in New York after this month.

David Goodale, superintendent of the Headlight mine and manager of the Trinity Exploration Co., Carrville, Trinity County, Calif., was in San Francisco recently.

George Bayha, manager of the Eastern Star mine, has returned to Redding, Calif., from Europe, where he negotiated the sale of the Golinsky copper mine, in Shasta County.

Dr. L. D. Ricketts, who returned from Europe about the middle of December, remained here until Dec. 21, when he proceeded to Cananea. He expects to visit New York again in February.

Albert Burch, of San Francisco, who represents the California Exploration Co., a Bewick, Moreing & Co. corporation, in the development of the Plymouth Consolidated mine in Amador County, Calif., returned in the middle of December from an examination of the Buckhorn mines in eastern Nevada. He visited the Plymouth last week to oversee the construction of the new electric hoist to be installed.

Beginning with Jan. 1, the Bureau of Associated Geological Engineers, an association of experts in geological and mining engineering—mostly former members of the U. S. Geological Survey—will maintain two offices. One, located in the Board of Trade Building, Boston, will be devoted to general geologic engineering, including the investigation of ore deposits and mineral properties, while the other, at 331 Fourth Ave., Pittsburg, will retain the management of its extensive work in the oil fields. M. L. Fuller will be in charge of the former and Frederick G. Clapp of the latter office.

OBITUARY

R. M. Brereton died at Woodstock, Ore., Dec. 7, aged 78 years. He was born in England, educated as an engineer and for 15 years was employed in India. He came to this country in 1871. For a number of years he was identified with mining and irrigation enterprises in California and the Northwest, and was associated with the Jonathan Bourne mining interests in Oregon.

Rue N. Hines died at El Paso, Tex., Dec. 13, aged 27 years. He was born at Toledo, Ohio, and graduated from the New Mexico School of Mines, at Socorro. For several years he was employed as a mining engineer in Mexico, and was well known in Guanajuato, Parral and other mining districts. Recently he went to El Paso and entered the banking business, being connected with the First National Bank and the First Mortgage & Guarantee Co., of that city.

Walter L. Hoyt died suddenly at Argo, Ill., Dec. 14. At the time he was inspecting the works of the International Smelting & Refining Co. He was born in New York 50 years ago. He was a graduate of Columbia University. He went to Denver to superintend the building and working of the refinery of the Grant smelter. From there he went to Sydney, Australia, and had charge of a smeltery there for four years. He then retired from active business, but a request from Dennis Sheedy to superintend the operation of a refinery at Perth Amboy brought him back into business. As soon as he had completed the selection of a factory site in Argo for his employers, he intended to go back to Perth Amboy, where he would have charge of the refinery. He was known as an expert metallurgist.

H. C. Meister, president of the Collinsville Zinc Co., died of heart failure on Nov. 27, 1911, at St. Louis, Mo., where he had resided for many years. At the time of his death he was 56 years of age. Mr. Meister was graduated from Washington University, as a mining engineer, in 1876. Soon afterward he became connected with the Collinsville Zinc Co., which was established in 1879. For a great many years this plant was operated with much success. It was a plant of Belgian furnaces, which, at the time of its construction and for many years subsequently, were of almost universal use in the West, but the Collinsville plant was superior to most of the constructions of its time, evidencing the thought and direction of a well trained and scientific metallurgical engineer. This was the first zinc-smelting plant in the United States to be built entirely above ground, save, of course, for the foundations, thus dispensing with the unsanitary and uneconomical subterranean furnace cellars that used to characterize zinc-smelting works, not only in the United States but also in Europe. Mr. Meister, jointly with Mr. Edgar, of the Glendale works, St. Louis, was the first to introduce mechanical reverberatory furnaces for blende roasting in the United States, and for many years the Brown horseshoe furnace was successfully in use at Collinsville. These few examples indicate Mr. Meister's intelligence and enterprise in the zinc-smelting business. In 1901, or about that time, when the old Belgian coal smelters had generally to be put out of operation, owing to inability to compete successfully with the smelters using natural gas, the Collinsville works also had to become idle. However, they were maintained in good repair, and from time to time were put in operation for short campaigns when market conditions enabled a profit to be made. Thus they were in operation in the early part of 1911. Mr. Meister was a member of the American Institute of Mining Engineers and contributed to its *Transactions* a paper upon the practice in zinc smelting of the time when it was written.

SOCIETIES and TECHNICAL SCHOOLS

American Institute of Consulting Engineers—The annual meeting will be held at the Aldine Club, New York, Jon. 16 next.

Mining and Metallurgical Society of America—The fourth annual meeting will begin at the Engineers' Club, New York, at 2 p.m., Tuesday, Jan. 9, 1912. The annual dinner of the society will be at the Engineers' Club, at 6:30 p.m., on the same date.

University of Idaho—On Dec. 13, C. Stewart, instructor in geology, gave a very interesting talk to the Associated Miners of the University, at their regular biweekly session. He spoke on the ore formation around Silver Bell, Ariz. The ore there occurs in a contact of igneous rock and limestone.

Editorial Correspondence

Reports from our own Representatives on Important Events from Many Important Mining Centers of the World

San Francisco

Dec. 21—The controversy in the special session of the legislature over water conservation is likely to end in making a bad matter worse, or at the best to result in no great improvement over the law enacted by the regular session of 1911, though it might be efficiently and wisely improved. Caminetti's bill, which was accepted by the supporters of the Glavis-Pardee measure, defeated in the assembly, has been passed by the Senate, but not wholly to the satisfaction of its advocates. The increase in tenure to 50 years from 25 years, as provided by the act of April 8, was a feature of insistence by conservationists, to which the opponents submitted after they had succeeded in exempting vested and existing rights which they declared fulfilled only constitutional requirements. The conservationists declared that the exemption of existing rights would result in the protection of purely speculative water claims and prevent legitimate development. The members of both houses are aware that no matter what measures they may adopt for enactment into a water-conservation law, they must coincide with the individual views and desires of Governor Johnson or the bill will be vetoed. Administration measures are the only ones that stand a chance of executive approval. The present water-conservation law will stand until a better one, according to the Governor's individual view, is passed by the legislature.

The Lost Hills Investment Co. is the latest incorporation to prepare for operation in the Lost Hills district. The directors are John C. Kirkpatrick, Frank H. Buck, J. A. Chanslor and O. Scribner. Chanslor and Scribner are reported to have disposed recently of some of their stock in the Associated, and Mr. Scribner and others of the Associated have recently taken active interest in gold and copper exploration. The organization of this new oil corporation revives the rumor of several months ago that the Southern Pacific R.R. was getting rid of its Associated stock and that a readjustment or reorganization of the large oil company was imminent. The new corporation is capitalized for $25,000, each director having subscribed for five shares of the stock at $5 per share. The Associated owns large interests in the Lost Hills. The Esperanza Consolidated has recently added 99 acres of patented land to its holdings in that district, and its well No. 1 is flowing 200 bbl. per day of 29.6 gravity oil. The Universal has settled its differences with the Associated and the new Associated pipeline is being supplied with light oil from these wells. So the Lost Hills district is coming to be an important factor in the oil industry and is particularly attractive for high gravity of the oil produced. The interesting feature of the situation just now, however, is the effect that the corporation of Kirkpatrick and associates will have on the interests of the Associated and the further development of the district.

Denver

Dec. 22—The drainage tunnel after all has not been an unmixed blessing to the mines of the Cripple Creek district, for Stratton's Independence has had to close down its mill for want of water. Wilson Creek, which was largely supplied by the discharge of water pumped from the mines, is bone dry, and so are some springs from which Stratton's got its supply, and the drainage tunnel, combined with the zero weather, has completed the drought. The average recession of water, according to Engineer Countryman, is now 10 ft. per month in all the deep shafts.

As an interesting piece of history it may be recorded that in 1890, Bob Womack, known as the "Father of Cripple Creek," discovered the first mine of the district in Poverty Gulch, and named it the "Gold King," since when it is credited with a production of over $7,000,000, and has paid $3,000,000 in dividends. A few years ago it was supposed to be a worked-out mine and was leased by the Gold King company to Owen Roberts, who is now producing about 30 cars of ore per month; the company has just paid a dividend of 3c. per share on its 1,000,000 shares.

The famous case of the Lost Bullion Mines Co., which has been pending for five years, is at last settled. The seven promoters were convicted at the first trial, of using the United States mails to defraud, and they appealed to the Supreme Court. They have now agreed to plead guilty and will lose their citizenship besides being punished by fine or imprisonment. A fine of $200 and costs was imposed by Judge Lewis on two of them. The others will appear in court in a few days. The mine in New Mexico was supposed to have been abandoned by Spanish adventurers centuries ago, and to contain enormous wealth in gold. Their literature was most artistic and fascinating and has never been excelled by other mining frauds in the country.

The electric railway between the Ophir mine and the mill of the Tomboy company is now bringing the output of the Montana mine to the mill. The property was recently purchased from the Revenue Tunnel Co. by the Tomboy company for $400,000. The Telluride district is still suffering from the effects of the washout on the Rio Grande Southern R.R. last year, and many of the mills have had to shut down until the repairs on the railway have been completed. The Alta mill is one of these, and during the temporary suspension of operations is making many improvements. Fourteen Wilfley tables are being installed, which, it is estimated, will be able to produce a carload of concentrates per day.

Butte

Dec. 20—The judgment secured some time ago by the State Savings Bank of Butte, against the Basin Reduction Co., in which F. A. Heinze is interested, and which amounted to $161,420 and interest, has been assigned to George E. Shaw and Franklin E. Potts, of New York, as trustees acting for the bank in a deal for the disposal of the Basin plant, where the Butte & Superior ore is being treated. In 1907, through the president and treasurer of the Basin Reduction Co., a note for $145,000 was given the State Savings Bank and no payment has ever been made upon it. The plant was sold recently after an attachment by the bank, but was redeemed again. Although nothing authentic has been given out, it is understood that a deal is under way for the sale of the plant, and it is possible that W. A. Clark is preparing to buy it to take the place of the concentrator of the Butte Reduction Works, where the zinc ore from his Elm Orlu mine was treated previous to the destruction of the plant recently by fire.

It has been decided by the directors of the Butte Coalition company to dissolve the corporation and to distribute its assets, consisting of 500,000 shares of Anaconda stock and $4,000,000 cash, *pro rata* among the stockholders on the basis of one-half share of Anaconda and $4 cash for each share of Butte Coalition. The Amalgamated company has arranged to take over the stock of the Alice Gold & Silver Mining Co., the basis of exchange being 7½ shares of Anaconda stock and $21 cash for each 100 shares of Alice stock. The Parrot Silver & Copper Co. will also dissolve and distribute in the

same manner 230,000 shares of Parrot stock in the proportion of 10 shares of Parrot to 3.916 shares of Anaconda and $2.50 cash.

Salt Lake City

Dec. 21—The new railroad-rate schedule, which went into effect Nov. 15, was reviewed at the annual meeting of the Commercial Club Traffic Bureau held Dec. 13. The schedule gives the following class rates: A $2.45 scale from Chicago; $2.27 rate from the Mississippi River; $1.90 from the Missouri River to Salt Lake, as compared with a $3 scale to the Pacific coast cities. The new rates affect everything shipped into the state under the western scale and are an average reduction of 15% from the former rates. There are about 200 additional carload commodity rates, which are as low or lower than the rates on goods carried from Chicago to the Pacific coast, giving an average reduction of 35% below former commodity rates. After Congress amended the fourth section of the interstate commerce law applying to the short and long haul clause, the bureau presented a report to the Interstate Commerce Commission seeking to have the clause applied to Utah on all shipments originating at the Atlantic seaboard and westerly from there. This is at present before the Supreme Court in an appeal by the railroads and the commission.

The Utah Consolidated, at Bingham, has been repairing its old tramway which was damaged some time ago as the result of the destruction of a tension tower by fire. A new headhouse has been partially built, and some of the arrangements at the upper terminal have been changed. This tram line will be used to ship lead ores to the Winnemucca mill, in lower Bingham. The lead ores are variously reported to occur on the lower levels or in the western section of the property.

Deadwood

Dec. 22—Black Hills operators were much pleased to receive the news of a postponement of the proposed increase of charges at the local United States assay office. The order increasing the charges was made by the Director of the Mint, to take effect on Jan. 1. It provided that the "assaying and stamping" charge should be one-quarter of 1% of the gross value of the bullion after that date. The original charge was one-eighth of 1%. Through the efforts of Congressman Eben W. Martin, and others of the South Dakota delegation, the order was "indefinitely postponed" by Director of the Mint Roberts and Secretary MacVeagh. The Deadwood office was excepted on the showing that on its present business it is practically paying expenses. Had the increase of charges taken effect, it would have been economical for Black Hills producers to ship their bullion to the Denver mint, where the assaying and stamping charges are not imposed on bullion deposited. To have shipped their bullion to this institution would have meant a considerable delay in getting returns.

A No. 6-K Gates crusher is being installed at the Wasp No. 2 mill, to take the place of a No. 5 machine. The No. 5 will not be removed, but will be kept as an auxiliary. This is one of the steps in the line of enlargement and expansion which the management is putting into effect, the first of which was the installation of a steam shovel for stripping. It has been announced that a shovel will be installed in the open cut next summer, for loading ore.

Negaunee, Mich.

Dec. 23—Amasa L. Mather, son of President Samuel Mather, has been elected secretary and assistant treasurer of the several Pickands, Mather mining companies, succeeding the late H. S. Hazelton. The Pickands, Mather companies include the Verona Mining Co., the Hemlock River Mining Co., the Calumet Ore Co., on the Menominee Range, and the Mikado, Brotherton, Sunday Lake and Pike mines on the Gogebic Range.

The tax levied on the Newport mine of Ferdinand Schlesinger, situated at Ironwood, is the largest for any Michigan mine, being but little short of $100,000. The exact figures are $98,996 on a valuation of $8,535,000. In the same city the Oliver Iron Mining Co. is to pay a tax of $170,000 on four mines, the Norrie, East Norrie, Aurora and Pabst.

Porcupine

Dec. 23—The first meeting of the Porcupine branch of the Canadian Mining Institute was held in South Porcupine, on Dec. 16. There were a number of visiting engineers present from Toronto and Montreal while a special car was run from Cobalt to accommodate the members from there. Several interesting papers were read and the proposed change in the Employers Liability Act was dealt with. A matter of considerable interest was the proposal to establish either a Mine Managers Association or a Chamber of Mines, such as is in existence in South Africa and Kalgoorlie. A committee was appointed from among the mine managers to investigate the matter. On the day following the meeting, the visitors were given a chance to see some of the properties and trips were made to the Dome, Hollinger, Vipond and Rea.

It is now known that the directors of the Preston-East Dome wish to obtain a 3-months extension of their option on the Preston claim, and that if this is not granted the option will be allowed to lapse, as the development work to date has not been encouraging. In this event the work will be confined to the East Dome claims on which there are some promising showings. With the Rea, in addition to the erratic grade of ore on the 300-ft. level, it is stated that the company is in need of money and that there will have to be a new issue of stock. As a general thing reports from the mines are favorable, and there is considerable activity, but new business remains stagnant, and there is not likely to be any great revival of interest until about March, when some of the mills are expected to start running.

J. W. Vandergrift, manager of the Lucky Cross mine at Swastika, was recently called before the magistrate at Englehart, to answer a charge brought by T. H. Sutherland, assistant inspector of mines, of not having the mouth of the shaft properly guarded as required by the Mining Act of Ontario. Mr. Vandergrift pleaded guilty and a fine of $100 was imposed.

Parral, Mexico

Dec. 21—The news from the several mining districts of the states still gives evidence of the influence of revolutionary reports. It is believed that the proposed railroad from Tepehuanes to Guanacevi, in the State of Durango, is being held back from this cause. Shipments from and development work in the Almoloya district are slowly increasing. Diamond drills have been used on several new properties and the position of orebodies has been predetermined for the first time in the history of some of the properties. At present, prospecting in the hills seems to be dominated somewhat by the state of the weather. The cold has kept some of the prospectors in, but since the weather has moderated somewhat it is believed that many will soon resume their work. The properties near this city are working with average forces of men, but, as a rule, the managers are not expecting to make increased shipments or to do more extensive development work until after Jan. 1, or until revolutionary reports cease to be of an alarming nature.

Reports as to labor conditions at Santa Eulalia are conflicting. Dispatches received recently state that some strike agitators have been in the camp endeavoring to influence the miners to strike. They are advocating higher wages and say that the latter can be secured if the miners strike and stay out for some time. It is believed that thus far these attempts have been unsuccessful. The authorities in Santa Eulalia have been notified and it is thought that the instigators will be arrested. Conflicting with these reports are the statements of several mining men who have recently arrived here from that camp, and who state that conditions throughout that district are perfectly tranquil, but that labor, for some cause, is somewhat scarce and is affecting the work to some extent; when the weather moderates it is expected that labor will be plentiful.

The Mining News

Reports of New Enterprises. New Machinery. Installations. Development Work and Property Transfers. The Current History of Mining

Alaska

The value of Alaska's mineral production for 1911 is estimated, by Alfred H. Brooks, of the U. S. Geological Survey, at $20,370,000. Of this amount $17,150,000 is to be credited to gold production, against $16,128,749 for 1910. It has been further estimated that the Alaska mines produced 22,900,000 lb. of copper in 1911, or more than five times the Alaska copper output of 1910, which was 4,241,689 lb. In addition to gold and copper, Alaska mines and quarries in 1911 produced silver, tin, coal, marble and gypsum to an estimated value of $390,000, an increase of over $200,000 as compared with the value of the same products in 1910.

Considerable excitement prevails at Dawson over a new strike at the head of Sixty-Mile River, where gold is being taken out amounting to about $1 per sq.ft. The creek is 30 miles long, and the gold is nearly all in the first 2 ft. of bedrock. It is reported that about 200 men have been on the trail for six days, traveling both day and night to reach the scene of the new discovery. The weather is severe, the temperature being about 40° below zero.

Cunningham—An option has been taken on this group of claims in the Seward district by the Kenai Dredging Co., which agrees to install a dredge next spring.

Irish World—Cotter, Hayden & Hawkins, owners of this group, have let a contract for extensive prospecting to be done this winter to determine whether the depth at which the pay streak lies will make dredging practicable.

Alaska-Treadwell—A large electric pump is being installed in the Mexican mine.

Kensington—This company is planning several improvements for the coming season on the property near Juneau. B. L. Thane is superintendent.

Arizona

Gila County

H. F. Wendelborn, who is leasing on the Nevada vein on United Globe ground, is shipping 20 tons per month of ore reported to average about 14% copper. The ore consists of carbonate and silicate of copper with some glance, in a siliceous gangue, and is shipped to the Old Dominion smeltery. The vein is from a few inches to 2½ ft. wide.

Miami—The sixth and last unit is being equipped and should be running in January. While foundations have been laid for three more units, they will probably not be covered and equipped for some time. The mine continues to hold up its end and has an enviable reputation for safety to the miners, as thus far not a man has been killed in the open stopes. The men work from the pillars and are always protected from falling rock.

Inspiration—The experimental mill is running steadily and the tests will probably not be completed before Jan. 1. The preliminary work at the dam-site on Pinal creek has been completed and plans are being made to sink wells on the Inspiration ranch, a few miles from the mine, to develop additional water supply. No work of a constructional nature has yet been started.

National—The company is clearing up its local indebtedness. All bills are being paid as presented and the payroll account is being settled. Supt. H. W. Woodward states that when this is finished the deed for the property will be conveyed to the Iron Cap Copper Co., that bought the property at a forced sale. The property consists of nine claims on Copper Hill, bounded on the east and the west by claims of the Arizona Commercial. It is developed by the Williams and the Iron Cap shafts, from which considerable drifting and crosscutting have been done. This work showed some encouraging results and it is expected that the new Iron Cap company will soon develop the ground to greater depth.

Old Ironsides—Lessees of this claim of the Copper & Silver Zone group, two miles east of Globe, shipped six tons of high-grade silver ore to the Old Dominion smeltery last week. The ore assayed 2.5% copper and 106 oz. of silver per ton.

New State Copper Mining & Smelting Co.—The company is doing assessment work for the current year. This company was recently organized under the laws of Arizona and holds 33 contiguous claims on lower Pinto Creek, 15 miles west of Globe. The ground is developed by four short tunnels and a 50-ft. shaft, and encouraging indications of copper-silver-gold ore have been disclosed.

Ray Eastern Copper Co.—This company, owning 10 claims, 1½ miles south of the Cole-Goodwin mine, in the schist area, is installing a small steam hoist, a pump and a small sawmill. The ground is developed by a 200-ft. shaft, from which about 300 ft. of drifting have been done. It is intended to resume development of the property. Seven men are now employed under Frank J. Lunn.

Live Oak—Station-cutting on the 900-ft. level in No. 2 shaft is in progress, and drifts and raises are being driven on ore at the eastern end of the orebody. Three churn drills are at work, one of them being in ore reported to be of good grade. A station pump is being installed on the 900-ft. level in No. 2 shaft.

Keystone—The company is operating one churn drill northwest of the shaft, but whether the ore reserve is being increased cannot be learned. The ore-bearing schist on this property is overlain by a sheet of granite porphyry.

Southwestern Miami—Churn-drill hole No. 2 is 130 ft. deep and is going down rapidly. The hole is being started with a 15½-in. bit, the largest ever used in the district, because of the great depth necessary to go before reaching the ore, which is estimated to lie 900 ft. below the surface at this point.

Black Warrior—Assessment work for the present year has been nearly completed. Spencer D. Wright, of Philadelphia, president of the company, has just completed a visit to the property and states that nothing has yet been decided as to the future policy. The option on control, held by the Warrior Development Co., a Duluth corporation, was relinquished a few months ago.

Sleeping Beauty—This copper company is employing six men on assessment work on its group of 20 claims, nine miles west of Globe, in the Sleeping Beauty Range. There are two quartz veins in granite, carrying copper, silver and gold, developed by several pits and a crosscut tunnel.

Pinal County

Ray Central—New financing is reported to be under consideration by the company. The plan is said to include an issue of $1,800,000 10-year, first-mortgage, 6% sinking-fund gold bonds, the proceeds of which will be used to pay off the outstanding $250,000 bonds, after which the mortgage securing the latter will be canceled. The plan is said to provide further for an increase in the capital stock from 1,200,000 shares to 1,900,000 and a reduction of the par value from $5 to $2. The new bonds will be convertible at any time within

three years into stock on the basis of $2 per share and will be redeemable at any interest day at 102½% of their par value.

Ray Consolidated—The fifth section of the mill has been tried out but will not be commissioned regularly until production has reached 5000 tons per day from the mine. The principal alteration in the mill has been the addition of more classifiers; of these two more banks have been installed in each section. The metallurgical results are said to have been excellent. It is expected now that each section of the mill will be able to handle from 1200 to 1250 tons per day. Ore hoisting is reported to have started through No. 2 shaft.

California

Amador County

Plymouth Consolidated—The new electric hoist under construction to be installed in February will have a capacity of 300 tons per day from a depth of 2000 ft. The mine will be unwatered and developed by the California Exploration Co. Albert Burch is the San Francisco representative. James F. Parks, of Plymouth, is superintendent at the mine at Plymouth.

Keystone—A suit has been instituted against the Keystone Mines by the Pacific Gas & Electric Co. for the purpose of determining the validity of the receiver's certificates issued by John H. Isham who was appointed by the Superior court in December, 1910. These certificates, amounting to $5230 out of $25,000 allowed by the court, were issued to defray the expense of keeping the mine unwatered. R. C. Downs is president of the reorganized company, which has recently purchased the mine of W. J. McGee, of San Francisco. New machinery will be installed and the 900-ft. shaft will be deepened to 1000 feet.

Butte County

Burlington—Preparations are being made for advancing the tunnel and sinking a shaft, with electric power, at this mine at Forbestown. The ore, of which there is about 2500 tons on the dump, is largely of the ribbon-quartz character, and from assays recently made runs from $4 to $10 per ton.

Calaveras County

Hanby—A millrun of 1000 tons is being made at this mine near Valley Springs by prospective purchasers. It is a comparatively new prospect, but has a good showing of ore in the 300-ft. shaft and drift. It is equipped with a 20-stamp mill. J. W. Hanby is owner.

Eldorado County

Judson—A new hoist has been installed and the installation of a stamp mill is contemplated. The vein has been prospected for about 600 ft., showing low-grade milling ore. William Judson, of Garden Valley, is owner.

Kern County

Salt reported to be 98½% pure is being taken from Dry Salt Lake, in the eastern part of the county.

K. T. & O.—Well No. 1, near the Lakeview, was brought in with a flow of 500 bbl. per day.

Mariposa County

Original—A flume for carrying water for the generation of electricity is being constructed at this mine on the Merced River, near El Portal. Fourteen cars of lumber have been received for the construction. Mine machinery is being installed.

Nevada County

Idaho-Maryland—It was not found necessary to stop the mill on account of a shortage of water, but the mine production was reduced. The mine and the mill are wholly dependent on water for power, but by curtailment of operations and economy there need be no cessation of work, since the weather indications are favorable. Mr. Nye is superintendent.

Midas—The pumps are being put in order to unwater the mine. A 5-stamp mill is contemplated to be used in the development to be done under bond by J. W. Young. Herbert James, a stockholder in the owning company, the Nevada County Midas, will have charge.

Shasta County

North Star—Extensive explorations are underway on this group of claims at Bully Hill, under the direction of S. E. Bretherton, of San Francisco.

Siskiyou County

Taylor Lake—This mine in Taylor Lake basin has been bonded to Chico men by the owners, Harris Bros. & Co., of Etna. It is intended to put the property in shape this winter for active operation in the spring.

Trail Creek—The new stamp mill has been installed. Development work preparatory to active extraction and milling in the spring will be done this winter.

Adeline Rocks—A millrun of 100 tons has been made at this mine on Sugar Creek. The stamp mill is modern. A 40-ton cyanide mill is contemplated. Operations will be resumed in March.

Trinity County

Trinity Gold Mining & Reduction—It is expected that a new orebody of large size will be opened north of the present workings on the Headlight property. Winter supplies sufficient for six months have been put in, and the mine will be worked steadily through the winter. David Goodale, of Carrville, is superintendent.

Trinity Exploration Company—Two Keystone drills have been in operation between Trinity Center and Carrville since Sept. 1, on the Gillette and Graves ranches. The purpose is to install a dredge if the results of the prospecting warrant. The heavy boulders in the ground will require a dredge of about 15-cu.ft. bucket capacity. H. W. Miller is president and David Goodale is manager.

Trinity Consolidated Hydraulic & Mining Company—The Hupp hydraulic and the Browns ranch placer mines and other properties acquired by this company in addition to the Union Hill will be increased in productive capacity by the acquisition, recently, of 500 in. of water. There are two 7-in. giants on the Union Hill, working under 400-ft. head, also one 6-in. and one 7-in. working under 250-ft. head on the Hupp.

Tuolumne County

App—G. Claus, of Paris, France, is examining the mine. It is reported that there is a probability that this mine and the Rawhide will be taken over by a French syndicate. These are among the old producers and are said to contain large bodies of ore. W. A. Nevills, of San Francisco, is owner.

Big Four—The vein disclosed by the winze recently started, is reported to be 4 ft. wide at the intersection. A raise to the surface will be made. New machinery is contemplated.

Colorado

Aspen County

Smuggler—New equipment is being installed at the shaft, and the old workings are being cleaned up ready for active work. The Federal Leasing Co., Bamberger & Matthews, managers, has obtained a lease on all of the mine above the 9th level and will sublet it in 100-ft. blocks.

Hope—This leasing company has commenced work on the Famous tunnel, and additional equipment is being installed.

Clear Creek and Gilpin Counties

Pennsylvania Mining & Power Co.—The Emerson vein, intersected by the Lucania Tunnel and owned by this company, is being drifted on and shows a large body of ore. The ore is 35 ft. wide, and the whole body will be crosscutted and carefully sampled. Leopold Sternberger is manager and F. Meyer is superintendent at the mine.

Scott—This mine on Republican Mountain, owned and worked by the Oklun Bros., is reported to have opened a new streak of ore, 10 in. wide, which assays ½ oz. gold, 35 oz. silver and 62% lead per ton; the shoot has been opened for 35 ft. in length.

Decatum—The mine in Willis Gulch is under lease to Matthew Daniels, who has opened up 12 in. of ore which runs $30 per ton. This property has been idle for many years and machinery will now be installed and the lower levels worked from the shaft which is 600 ft. deep.

CRIPPLE CREEK DISTRICT

Commonwealth—A good body of ore has been opened by the lessees at the mine, and production will be begun at once. The stockholders' meeting has just been held at Decatur, Ill. W. W. Wilkinson was elected president.

Free Coinage—The present output of this mine is about 800 tons per month. The company is a close corporation, of which J. B. Neville is president and general manager.

Stratton's Estate—In a shaft 30 ft. deep, near the Logan mine, on Bull Hill, W. H. Brown, lessee, has opened a vein of gold ore yielding $30 per ton assays.

DOLORES COUNTY

Rice-Wellington—It is reported that Jesse Knight and associates, of Provo, Utah, have taken over the control of this group, from which were recently shipped 12 cars of $50 ore to Salt Lake City.

Rice-Argentine Co.—This company has been incorporated by Salt Lake men and has taken bonds and leases on the Argentine group of six claims and the Black Hawk group of eight claims, all patented, and situated on Telescope and Black Hawk Mountains, in Silver Creek Basin. Work has already been commenced in the main tunnel. Clinton D. Ray is manager.

LAKE COUNTY-LEADVILLE

Sugar Loaf—Regular shipments of ore, of which smeltery returns show 50 oz. silver and some gold per ton, are being made from the Sherill claims.

Hibschle—From this mine, at the head of East Seventh St., the lessees are making regular shipments of iron ore, with an occasional car of lead ore.

Jonny—Work has been started on No. 4 shaft by T. G. Morrissey, lessee, who has obtained a lease on several blocks on the eighth level.

Famous—Shipments of lead-carbonate ore, with gold content, are going out regularly from the mine in Big Evans Gulch.

OURAY COUNTY

Camp Bird—During the three months ended Oct. 31, 1911, the mill crushed 18,509 tons of ore, yielding $513,638 gross, and net $378,126. Working expenses, including development, transportation and treatment charges were $135,512. The estimated profit from the company's holdings in the Santa Gertrudis were £36,720, the new mill being in full operation since Oct. 1.

RIO BLANCO COUNTY

Albert Sutter, forester of the White River forest reserve, reports the discovery on Piceance Creek of large deposits of elaterite. The chief deposits of this hydrocarbon are on Indian and Sam Creeks, in Uintah County, Utah, and this is the first that has been discovered in Colorado.

SAGUACHE COUNTY

Bonanza—This mine, operated by Horrigan Bros., is stated to be on a paying basis now, 30 tons of ore being produced daily from the lower levels. The new mill is said to be running smoothly and a large compressor has been installed.

SAN JUAN DISTRICT

Japan-Flora—Negotiations for the sale of this mine, in Savage Basin, Telluride, are underway. The mine is extensively developed, and if the sale is made a mill will be erected. J. J. Fisher, of Pittsburg, Penn., and associates own the property.

SAN MIGUEL COUNTY

It is reported that a new mill to treat the vanadiferous sandstone will be built at Newmire, on the east side of the river. The Primos Chemical Co., of Primos, Penn., is operating the mill already there, treating about 30 tons per day. This mill is running through the winter this year for the first time.

Tomboy—The company is sending down its concentrates to the loading station by the Smuggler tram.

Black Bear—A force of 30 men is at work, but the mill has been closed for the winter on account of water shortage. E. J. Carter is manager.

Idaho

COEUR D'ALENE DISTRICT

Blue Bell—A contract has been let by this company to run 200 ft. of tunnel. Two wagon loads of supplies and material have been taken up to the property and work is to begin at once.

Federal Mining & Smelting—Regarding this company the following notice has been issued over the signature of M. Guggenheim's Sons: "Statements have been made in the public press to the effect that the Guggenheim interests have, from time to time and recently, sold or traded in the stock of the Federal Mining & Smelting Co., the statement further being made that the recent decline in this stock was doubtless due to selling on the part of the Guggenheim interests. Such statements are without any foundation whatever, and are false. The undersigned desire their friends and the public in general to know that none of the Guggenheim brothers and no company in which they are interested has at any time bought or sold, or owned, or traded in any of the preferred or common stock of the Federal Mining & Smelting Co., except that a number of years ago the American Smelters Securities Co. purchased at private sale a portion of the common stock. This interest is approximately only one-sixth of the entire capital stock of the Federal. The Securities company still owns every share of this stock which it so purchased. The above statement indicates the only interest, either direct or indirect, which the Guggenheim brothers have had in either preferred or common stock of the Federal Mining & Smelting Company."

Snowstorm—This company will erect a new concentrator and leaching plant. The property is practically the only paying copper mine ever developed in the Cœur d'Alene district. The old leaching plant was designed to treat the carbonate ores, and proved inefficient when used on the sulphide ores and the new plant is intended to treat these sulphides. The plans are now being made and construction work will start soon. It is reported that lead has been found in the lower tunnel.

Georgia

North American Chemical Co.—This company has been organized at Rome, with $500,000 capital stock and the following officers: President, H. H. Shackelton; vice-president, T. E. Grafton; secretary, J. E. Dean. The company has purchased 1000 acres of land containing halloysite deposits, and is reported to have driven tunnels and crosscuts blocking out many tons of the ore, which it is proposed to treat with sulphuric acid for producing aluminum sulphate, utilizing a process invented by P. H. Carter, a Rome chemist.

Michigan

COPPER

New Baltic—The crosscut from the 500-ft. level has cut through the first of the series of two formations at a distance of about 135 ft. from the shaft. This formation is about 30 ft. wide and is well mineralized. The crosscut at the level above found the two series to be about 70 ft. apart and the crosscut from the 500-ft. level will be extended to reach the second formation.

Algomah—A crosscut is being driven from the 200-ft. level to reach the horizon of the Lake lode. A drill hole recently encountered an amygdaloid formation at a depth of about 2090 ft., the core showing an encouraging amount of copper. A copper-bearing lode was passed through by this hole at a depth of about 1870 ft., showing it to be nearly 100 ft. thick, but carrying copper only in small amount. This hole will continue sinking to secure additional data for the identification of this lode.

Hancock—The vertical shaft has passed through the vein that was cut at a depth of 3100 ft. and the shaft is now sinking in trap on its way to cut the Quincy-Pewabic lode. The formation recently encountered may be opened later, but all attention is now centered in getting the shaft down to the objective point.

Houghton—A new lode is reported to have been cut at a point 75 ft. east

of where the diamond-drill work indicated the Superior lode to be. It is said that the new vein is 25 ft. wide, all commercial grade.

Old Colony—During the year ended Sept. 30, 1911, operations were confined to diamond drilling in a zone about 2000 ft. wide in the eastern part of the property near the Eastern Sandstone. In the first cross-section 3042 ft. of drilling were done in five holes, covering a horizontal distance of 2180 ft., across the formation. In several holes copper was found in varying proportions. The drill at present is working on No. 12 hole, in the second cross-section. Total receipts for the year were $86,453, derived principally from assessments and sale of treasury stock; expenditures were $12,260, of which $4927 were for diamond drilling; balance on hand, Oct. 1, 1911, $74,193, since when $7616 have been received in assessments.

Iron

Efforts are being made to find ore in the Bay de Noc district near Escanaba. Christian Skaug has been securing options on land along the east side of the bay. Several attempts have been made to find ore in that vicinity, the last by Michael Gunter, who operated a diamond drill there a year ago. To most mining men it appears as rather a forlorn hope to explore at so great a distance from the known iron formation.

Salisbury—This mine of the Cleveland-Cliffs Iron Co., in Ishpeming, will be closed for several weeks while repairs are being made to the shaft. The majority of the 150 miners employed are temporarily idle, only a few being retained for the repair work.

Moro—At this hard-ore mine of the Cleveland-Cliffs company, situated on the southeast edge of the city of Ishpeming, preparations are being made to close the property. The orebody is nearly exhausted and it is probable that the mine will be closed after this winter. The property was opened in 1884, when Don H. Bacon was the Cleveland-Cliffs Iron Co.'s agent. About 100 men are employed, most of whom will be transferred to the company's other mines, as the hard-ore mining has developed a skilled force of miners.

Montana

Butte District

Anaconda—For the purpose of providing an air shaft, as well as a secondary shaft to be utilized in lowering timbers and supplies to the levels of the Badger State mine of the Anaconda company, the Emily shaft, situated about 500 ft. northeast of the main shaft, is being sunk, two compartments wide, and has now reached a depth of over 400 ft. The shaft, which has been continued from a depth of nearly 200 ft., to which point it was sunk several years ago, has been completely retimbered to the collar. A single-compartment hoist is being operated for sinking purposes and the other compartment is being used to carry the compressed-air pipe for operating the machine drills and also a water column.

La France—Because of continued default in the payment of interest on $2,000,000 first mortgage bonds, a committee has been formed to rehabilitate the property. It is believed that the future of the property lies in the zinc ore and that about $500,000 will be needed to put the mine on a working basis. A new concentrator is a possibility. Engineers representing the protective committee will soon examine the property.

United Copper—Stockholders are in receipt of a circular from Calvin O. Geer, president of the newly organized United Copper Securities Co., announcing the formation of such a company with $4,000,000 capital, including $2,000,000 6% cumulative preferred stock and $2,000,000 common stock. United Copper shareholders have the opportunity to trade in their shares in several ways.

Deer Lodge County

Holdfast—The mine is being operated by Robert Lindberg, who makes occasional shipments of ore to the Washoe smeltery.

Old Bonanza—A lease and bond has been taken on the mine in the Silver Lake district from the owner, Thomas McGrath, by Anaconda men. A tunnel will be driven 150 ft. on the vein by the leasers. The product is principally silver ore.

Lincoln County

In preparation for the building of the power plant, to be constructed at Yakt Falls, the sawmill at Sylvanite, 35 miles northwest of Libby, is running steadily with a force of 27 men employed in the mill and in logging work. Lumber is now being cut for the construction of flumes for the power plant of the Milwaukee Power Co., work upon which will begin in the spring. The mill has finished sawing the lumber to be used in erecting a mill at the Sylvanite gold mines.

Madison County

Montana-Revenue—This company, owning the Revenue and Monitor mines on Richmond Flats, near Norris, is the defendant in a suit recently begun by Samuel Newhouse. Mr. Newhouse is suing to foreclose a mortgage for $30,000, given him by the defendant company on the Hidden Treasure lode claim, Nov. 17, 1909, and he asks judgment for this amount with interest at 5% per year from that date, $1000 attorneys' fee and costs of the suit. Until a few years ago the Revenue and Monitor mines were among the largest gold producers in Montana.

Gold Coin—Operations on the 350-ft. level had to be suspended recently because of a heavy flow of water; the level was flooded quickly, and until pumps can be installed there will be no work done below the 300-ft. level. The question of water supply for the mill, however, is solved by this.

Nevada

Nye County

Montana-Tonopah—A special meeting of the stockholders will be held Jan. 9, in Salt Lake City, to act upon a proposal to organize a new company to be known as the Montana-Tonopah Mines Co., to acquire all assets and operate the Montana-Tonopah Mining Co. The new company will be capitalized at $1,000,000, par value $1 and non-assessable. The exchange will be share for share. Stockholders will receive with their dividend check No. 5, a statement showing cash on hand, after the present dividend and all obligations to date, amounting to $204,616, have been paid.

White Pine County

Giroux—Water in the main shaft has been lowered to a point about 13 ft. above the 1400-ft. level. Machinery from the Old Glory shaft is being moved to the new hoisting plant at the Morris No. 2, which is to be the main working shaft, from which the concentrator will be supplied with ore.

Nevada Consolidated—Ore shipments are reported to have been started from the Veteran mine and the management expects soon to be able to supply a regular tonnage daily to the Steptoe smeltery. Mining is done by the caving system on contract. About 125 men, including surface labor, are at present employed at this mine, but this number will be increased soon. The strike of the churn-drill men at Copper Flat has been settled by compromise and work has been resumed. Ore shipments have been averaging about 7000 tons per day to the Steptoe smeltery. The latter has been short of water and shipments have not been rushed. Churn drills are reported to have revealed commercial ore at a depth not practicable for shovel work but workable by ordinary mining. Regular stoping has commenced at the Veteran mine, following exploratory work.

New Mexico

Juab County

Chino—It is reported that during the first four weeks that the concentrator was in operation average extraction amounted to 66% on oxidized surface ores running between 2.75% and 3% copper. One unit was used and treated about 750 tons per day, which is the amount now being treated. The output from this tonnage is about 30,000 lb. of copper per day. The second unit will be started soon.

Tennessee

American Zinc, Lead & Smelting Co.—This company is planning to build a concentrating mill of 1000 tons daily capacity at Mascot.

Utah

Beaver County

South Utah—During November, 25,205 tons of ore were milled, from which 2256 tons of concentrates were obtained. The ratio of concentration is about 11 into one. The November tonnage is the largest yet treated and produced 361,681 lb. copper, 2742 oz. silver and 140 oz. gold. An average recovery of 61% was made. The concentrates carried 8.28% copper. The production for the first two months of the company's fiscal year, October and November, totaled 688,259 lb. copper, 5461 oz. silver and 274 oz. gold.

Cedar-Talisman—Drifting is being done in three places on the 500-ft. level. The east and west drifts are crosscuts, while the drift to the north is following the fissure and is 600 ft. from the shaft. Some softer mineralized ground is reported. The country rock heretofore has been a hard, black quartz.

Bonanza—There is a good showing in the shaft, which has been sunk 60 ft.; the ore carries free gold.

Beaver Gold Mining—This property, which is north of the Bonanza, has been worked for the last few weeks. The shaft is down 26 ft., and has 2 ft. of ore in the bottom, which is improving with depth.

Red Warrior—A car of ore was shipped Nov. 17, and another is being loaded.

Black Bird—A streak of chalcopyrite has been opened on the 300-ft. level. This is in the southern part of the property and is making toward the Cactus.

Juab County

Beck Tunnel—According to reports, the company is opening in the southern part of its property the most important body of ore since the discovery of the original Colorado ore channel.

Colorado—On the 300-ft. level, work is being done at a point where ore from the upper workings is expected.

Dragon Consolidated—When the ore bins are completed, shipments will be started from the new orebody opened through the Iron Blossom workings. The ore will be sent out through the Iron Blossom No. 1 shaft.

Black Jack—The Higginson & Salisbury lease, in the old Star Consolidated section, is reported to be mining some good ore. This lease is on all the old workings between the 200 and the surface and regular shipments have been made for several months. Some small bunches of rich ore have been found.

Victoria—Ore is being mined on the 1200-ft. level, and raising in good ore is in progress. This is thought to be a continuation of the body opened on the 1050-ft. level and other levels. A fair tonnage is being marketed.

Sioux Consolidated—Connections have been made between the 600- and 450-ft. levels, but no new orebodies have been developed.

Montana—The contract to sink the shaft has been taken by Ralph Kellogg, and work has been started. The present depth is about 200 ft. and the hoisting equipment, compressor, etc., are in good working order. Sufficient work will be done to cover this year's assessment on 14 claims.

Lower Mammoth—Work is being done on the 1000- and 1700-ft. levels. The crosscut on the former level is being driven west to prospect for the southern continuation of the Centennial-Eureka and Grand Central ore zones.

Opohongo—The new ore bins will soon be completed and the company will be in a position to ship more than double its present output. Two cars per week have been shipped, paying expenses, beside leaving a small surplus. The ore is of good grade and the vein has recently been opened on the 700-ft. level. The ore carries about 12% copper, 8 or 9 oz. silver and $3 in gold.

Uncle Sam—Preparations are being made for drifting in two directions on the new orebody recently opened in the western part of the property.

Yankee Consolidated—Work on the 1900-ft. level has opened ground in two places from which good assays have been obtained. No ore has yet been opened but the mineralization is promising.

United Tintic—This company shut down recently on account of the difficulty in getting coal. Pumping has been stopped. The flow is about 90 gal. per min. A 40-ton shipment is ready and it is reported that operations will be resumed soon. A lease has been taken on that part of the ground reached from the old Tintic Combination shaft and drifting is being done at a depth of 150 feet.

San Juan County

Bluff & Norwood—The Galloway well, in the San Juan oil field, was brought in at a depth of 1800 ft. The oil occurs in what is known as the Honaker sand and oil is reported to have risen nearly to the top of the well. Arrangements to install pumping machinery are being made.

Utah County

Hiawatha Mining—This company was incorporated at Provo, Dec. 13. The capitalization is $100,000, divided into shares of 10c. Jesse Knight is president. The company has taken over claims in the Provo mining district.

Washington

Redwood—The company is calling for bids for shaft work at its mine in Stevens county. T. F. James, Chewelah, is manager.

Surprise—The ore encountered on this property, at Republic, Ferry County, warrants increasing the output by the addition of considerable new machinery soon. The mine is at present producing 50 tons per day.

Tungsten Consolidated—New machinery is being installed at this mine, in Spokane County, of which W. A. Brockway, Spokane, is manager. The ore is averaging $500 per ton, and there is about 7500 tons available.

Canada

British Columbia

Granby—Three furnaces at the smeltery were blown in, Dec. 21, and six more on Dec. 22. This marks the resumption of smelting operations, discontinued since August on account of the coal miners' strike.

Surf Inlet—Frederick M. Wells, manager, recently left for this property on Princess Royal Island with a number of miners, in addition to those already at work. Twelve tons of supplies have been brought in and actual development work will start at once. A mill is to be installed and a power plant constructed in the summer.

Ontario

Olympia—This mine, Lake-of-the-Woods district, is being operated by G. H. Vernon, manager, with a small force. A car returned from dumping it ran with him over the edge of the shaft.

Hedstrom—The firm of E. L. Hedstrom, Buffalo, N. Y., which operates the Fairmount coal mines in the Allegheny Valley, formerly owned by the Pennsylvania R.R., is opening an iron mine on the north shore of Lake Superior. Some extensive core drilling made on the property recently reveals the fact that the hard, quartzlike rock carries about $8 in silver per ton, but it is thought not worth working, on account of th difficulty of extraction.

Ontario—Cobalt

Cobalt Townsite—By a premature explosion when loading holes at the 200-ft. level, Wilfrid Mandly, a drill runner, was killed, and Archibald McDonald, helper, was seriously injured.

Silver Leaf—J. Graham, an employee of the Crown Reserve, by which the Silver Leaf is operated, was instantly killed on Dec. 21, by falling down the shaft. He neglected to lower the guard rail when taking the car off and when the car returned from dumping it ran with him over the edge of the shaft.

Casey Cobalt—This property, situated about 10 miles northeast of New Liskeard, has been operated for three years with workings on six levels, the deepest being 310 ft. Seven cars of ore have recently been shipped and there is a large dump of low-grade ore. Some of the ore shows good gold contents. Two additional 50-hp. boilers are being installed.

Coniagas—The annual meeting of the Coniagas Mines and Coniagas Reduction companies was held at St. Catharines, Ont., on Dec. 18. The mines company's statement shows cash in hand and ore totaling $920,002. During the year 169 tons of ore were crushed daily and a total of 3,789,274 oz. of silver were shipped at a cost of 8.8c. per oz., as compared with 13.285c. per oz. the previous year. The engineer's report estimates the ore in sight at 12,516,000 oz. The smeltery at Thorold treated 2869 tons of ore and shipped 5,642,803 Troy oz. of fine silver.

Dr. Reddick—Additional funds have been subscribed to carry on the work at this Larder Lake property. The mill has now been running for several weeks.

Colonial Silver Mines—The company has filed a petition in bankruptcy, with liabilities of $92,984, contracted between 1908 and 1911 for borrowed money; assets, $2100 cash and 100,000 shares of stock of Colonial Mining Co., value unknown. There are five creditors, among whom is Harry Payne Whitney, with the largest claim, $25,000. It is said that a large amount of money was spent in unsuccessful development work.

ONTARIO—PORCUPINE

Dome—At a recent meeting it was decided to increase the number of directors from five to seven.

McIntyre—An oreshoot has been discovered under Pearl Lake from the No. 4 shaft of this property.

Little Pet—This company has ordered a 5-stamp mill.

Porcupine-Hudson Bay—Montreal men are negotiating for the control of this property.

Keora—This property is being examined for a firm of Boston brokers.

Plenaurum—A discovery of good ore has been made on the 125-ft. level of the No. 2 shaft.

Davidson—Crosscutting the vein at the 100-ft. level is giving satisfactory results.

Painkiller Lake—Some good finds have recently been reported from gold properties in this district.

Rea—President C. Plummer Hill has issued a statement to the effect that the ore shown in the crosscut at the 300-ft. level has been somewhat disappointing, but that final tests will not be made until the new assay and testing plant is completed. The main shaft will be put down to the 400-ft. level, for which purpose a new hoist has been ordered. A shaft has been started on a recently discovered vein, which intersects the main vein near the Eakins shaft. The main shaft will be sunk 100 ft. further.

Dome Extension—The main shaft has been sunk 200 ft., and an additional 20 ft. for a sump and timbered throughout, with stations at the 100- and 200-ft. levels. Crosscuts on both levels are now heading north toward the mineralized zone, on which there are six known veins.

Porcupine Gold—Nos. 2 and 3 veins have been cut at the 200-ft. level, presenting similar characteristics to those prevailing at 100 ft. The compressor plant has been installed.

West Dome—The bonanza sulphide vein has been cut, showing 200 ft. of mineralized matter between the walls.

Eldorado—A contract for sinking has been let to C. H. Brenner, and the work will proceed immediately.

La Palme—Ore carrying free gold has been found at a depth of 35 ft. in No. 2 shaft.

Mexico

CHIHUAHUA

Providencia—Plans for the resumption of work at this lead-silver mine at Parral are being made. The property is controlled by the Mollie Gibson company of Boston. E. Putnam is in charge. The shaft is down 470 feet.

Virgen—Rich gold ore has been found in this new mine at San Sostones, 60 miles east of Chihuahua on the Conchos River. It is owned by Don Luis Terrasas. Placers were formerly worked in the district.

San Toy—Suit to recover stock in this Santa Eulalia company has been brought in the New York courts by Sydney A. Witherbee, of Mexico City, against Charles M. Schwab, of Pittsburg, and associates. The mine is being actively operated and is paying large dividends.

Middle Mountain—This company owning the Presidente mine at Naica has suspended all operations for the present. Plans for raising more funds are being made. The office of the company is at San Antonio, Texas.

Germania—This property on the Veta Colorado at Parral has been taken under option by Paul Ginther for an European syndicate. The same interests have also taken options on a number of other properties in the district and have located several hundred pertenencias of new ground. L. F. Johnston is associated with Mr. Ginther in the negotiations.

Cocheño—This mine in western Chihuahua, owned by the Corrigan, McKinney interests of Cleveland, Ohio, is now receiving electric power from a steam plant using wood. The cost is now approximately $40 per hp. per year. The shaft is down 900 feet.

Europa—A local company is developing this property east of El Tajo mine. The shaft is down 300 ft. An option for $150,000 has recently been given to California operators who have also an option on the Hercules claims adjoining on the east.

Iguana—This Parral mine is shipping regularly from the new shaft.

Revancho—Operations at this mine in Minas Nuevas have started. Shaft sinking is in progress and 40 men are employed. The property is being worked by Paul Ginther, under lease from Jose M. Botello.

Esperanza—During November the mill crushed 20,932 tons of ore. Gross receipts for the month were $132,979; net profit, $21,733. Operating expenses were $103,729 and 1336 ft. of development work were done.

Candelaria Mining Co.—The mines of this company at Minas de San Pedro have been entirely closed down, owing to the continued disturbances in that part of Mexico.

DURANGO

Mexico Consolidated—The reorganization of this company is being effected. The property is at Guanecevi and is extensively developed and equipped with a large mill. The mill has been operating in a small way recently but development operations are suspended. The House of Stallforth at Parral is largely interested.

SINALOA

Compañia Minera Occidental Mexicana—This company under the direction of E. A. H. Tays expects to develop some promising properties, in 1912, in the Fuerte district. Headquarters will be at San Blas.

SONORA

La Cobriza—It is expected that the smeltery operated by this company about 17 miles west of Noria will soon be blown in. The plant includes a 100-ton MacDonald blast furnace. At the mine the shaft is being sunk from the 500- to the 1000-ft. level. The ore is said to average about $16 per ton and the ore-bins, capacity 2000 tons, are full. Coke amounting to about 200 tons is on the ground, ready for the smeltery. Freight is reported as being successfully handled with a motor truck.

Africa

TRANSVAAL

Gold production of the Transvaal in November was: Witwatersrand, 691,462 oz.; outside districts, 28,267 oz.; total, 719,729 oz., or 11,085 oz. more than in October. For the 11 months ended Nov. 30, the total was 6,893,108 oz. in 1910, and 7,527,815 oz.—or $155,599,936—in 1911; an increase of 634,707 oz. this year. The total number of negro laborers employed Nov. 31 was 194,850, a decrease of 3791 during the month.

The Markets

Coal Trade Review

New York, Dec. 27—In the West there has been a little revival of trade consequent upon the coming of colder weather and a better demand for domestic fuel. Business generally remains quiet, however. At several points there are complaints that the activity of early December, together with the free car supply, has tended to cause heavy shipments from the mines. The markets are rather overstocked in consequence, and prices are inclined to be low.

In the East the seaboard bituminous trade is in fair condition only. Demand for manufacturing supplies remains unchanged, but there seems to be more coal at tidewater at some ports. At Hampton Roads, however, the condition is the other way, coal being rather scarce. All-rail trade is fair.

Coastwise trade is slow, owing to the short supply of vessels. Rates are high and unsteady. There has been much delay, owing to stormy and foggy weather.

Anthracite trade is steady, being affected by the weather in some degree, but not to any great extent.

Pittsburg advices report that the coal operators of western Pennsylvania and Ohio will refuse to join the Illinois and Indiana operators in reviving the old Interstate agreement for the settlement of wage questions. The Pittsburg operators say that Illinois was the first to break the old agreement and make an independent settlement with the miners, and for that reason they oppose any renewal. Moreover, they claim that they cannot afford to make any general agreement as long as West Virginia remains a nonunion state, and continues to compete with the Pittsburg district for Western business.

A Pittsburg dispatch reports that the River & Rail Coal Co. has sold its property to parties representing the Grand Trunk Ry. Co. of Canada. The property includes 31,000 acres of land in Belmont County, Ohio, on which are six mines, having a capacity of 750,000 tons of coal yearly. The object of the Grand Trunk is to secure a coal supply for its lines under its own control.

Coastwise shipments of coal from chief Atlantic ports, 10 months ended Oct. 31, in long tons:

	Anthracite	Bituminous	Total
New York	11,741,606	8,821,776	20,563,382
Philadelphia	1,784,309	4,041,941	5,826,250
Baltimore	209,103	3,448,739	3,657,842
Newport News	.....	2,212,036	2,212,036
Norfolk	.....	3,791,794	3,791,794
Total	13,735,018	22,316,286	36,051,304
Total, 1910	12,849,394	21,508,798	34,358,192

Increase in anthracite this year, 885,624; increase in bituminous, 1,807,488; total increase, 2,693,112 tons, or 7.8 per cent. New York covers all the harbor shipping points and includes barge deliveries to city and neighboring wharves.

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

IRON TRADE REVIEW

New York, Dec. 27—The iron and steel markets continue active; remarkably so for the closing week of the year. Sales are lighter, but contract specifications are coming in freely.

For about six weeks all the reports from the iron and steel industry have been extremely good, telling of increased bookings and stiffening in prices. It should therefore be pointed out now that this movement is over. The contracts have been placed, and there is no occasion for much more business along this line. As to specifications, with this week the active period will be over for the time being, buyers having taken advantage of their low-priced contracts and having also put in specifications upon other contracts for such material as they know they will need. Next week and week after they will be busy with annual inventories and specifying is likely to be relatively light. It may be that the recent movement will be taken up, late in January, where it has been left off, but for the next two or three weeks no particularly favorable developments marketwise need be expected. It should be observed that the Jan. 1 inventory is a much more important affair since the corporation-tax law was passed than it was before.

Increase in production will be considerable at the beginning of January, due to the heavier specifications lately received. It is understood that the Steel Corporation will increase its operations to between 80 and 85 per cent. of capacity, against 75 per cent. in the past two or three months. It is understood it has already blown in three blast furnaces, one at Sharon and two in the Pittsburg district.

More railroad buying is reported in the shape of orders for cars and bridges. Rail orders are increasing and the total for next year promises to be large.

Pig-iron orders continue on a good scale, though perhaps not as large as they were a week or two ago. Enough have now been placed to relieve the furnaces of a good part of the stocks they have been carrying, and to put them in a better position than they have been for a good while back. Without any marked advance, there is a tendency to more firmness in prices, especially for any deliveries after the first quarter of 1912. Southern sellers, especially, are asking such advances, being encouraged by the recent large sales. Some of those sales, it is said, were of a speculative kind, but it is not believed that the quantity of iron bought to be held for an advance is very large.

The Association of Sheet & Tinplate Manufacturers has been organized at Pittsburg, the object being to collect and furnish to members information concerning the trade; and to push the use of sheets and similar products.

The Eastern Steel Co., Pottsville, Penn., has leased the blast furnaces of the Warwick Iron & Steel Co., at Pottstown. This plant has four stacks with a total capacity of 275,000 tons of pig iron yearly. The Eastern Steel Co. owns no blast furnaces, but has a steel plant and rolling mill of about 225,000 tons capacity. The company has recently acquired iron-ore lands in Cuba, near the property of the Spanish-American Iron Co., partly by purchase and partly by lease.

Baltimore

Dec. 25—Imports for the week included 1130 tons ferromanganese from Liverpool; 6735 tons iron pyrites from Huelva, Spain; 27,768 tons iron ore from Cuba.

Birmingham

Dec. 27—The better feeling in the market continues to prevail, though buying of iron has fallen off, as might be expected after the heavy sales of the past few weeks. Makers, however, believe that this is only temporary, and that business will look up again after the holidays. There is a little iron still in storage, but the quantity has been pretty well cut down, and will be cleared out still more as present orders are filled.

Only a little iron, a few scattering lots, is still to be had at $10 for No. 2 foundry. The current price for the first quarter of 1912 is $10.25, and $10.50 is named for deliveries after April. It is said that some of the iron sold early this month was to buyers who are inclined to speculate for a rise. Makers generally deny this and the quantity any way cannot be large.

Cast-iron pipe makers are still busy, with good orders on hand. Local foundries and machine shops are looking for better business after the new year.

Only the usual stop for holidays and repairs is on at the steel works and rolling mills. More orders for steel rails from the Ensley mills are reported.

Chicago

Dec. 26—Buying of pig iron and finished products in the last week has not been very large, but the pace of improvement set by the previous two or three weeks has been maintained and there is every prospect that it will quicken as soon as the holiday season is over. For a before-Christmas week the record has been excellent. The founders in all parts of Chicago territory are disposed to buy more heavily and for farther deliveries; manufacturing is improving and it would seem that the time of free buying of both pig iron and finished products has come. Yet the largest interests are cautious about their prophecies and some persons well versed in the trade say Chicago has not yet profited out of the improvement in the general iron and steel situation as much as other—chiefly Eastern—cities. The reason for this is considered to be large production for the needs of the Mississippi Valley, with no such increase in consumptive ability as the East has developed.

Southern No. 2 pig iron holds to $10.50 on most business now, though some sales are said to be made at $10, Birmingham. These prices are equivalent to $14.35 @14.85, Chicago, and in competition with them Northern No. 2 iron sells for $14.25 @14.75, the lowest figure in the last few weeks, $14, being possible on some transactions. The efforts of the pig-iron sellers to hold up the price seem destined to success, in view of the very general buying of iron.

Local railroad purchases continue moderate, but are increasing; structural material is quiet but much figuring is being done on heavy prospective needs; plates, sheets and bars are quiet, and local sales of bars are still under the influence of Pittsburg competition with prices consequently low. Wire goods are in excellent demand and strengthening.

Cleveland

Dec. 25—Ore on Lake Erie docks, Dec. 1, was 9,131,664 tons, only 295,217 less than a year ago. With present prospects for furnace activity, it looks as if these stocks will be drawn down pretty well before next spring.

Pig Iron—A purchase of 2000 tons of bessemer pig by a Cleveland furnace is noted. There is good inquiry for both foundry and basic pig, and prices are more firmly held, though they have not advanced. Quotations, Cleveland delivery, are $15.15 for bessemer, $13.25@13.40 for basic, $13.25 for No. 2 foundry and $12.50 for forge iron.

Finished Material—Business is good in nearly all lines, and prices are firmer, especially for bars and sheets. Mills are beginning to get into better shape, and there is less hustling after work.

Philadelphia

Dec. 27—Pig-iron makers have made a nominal advance in iron and assert that it is the only price at which orders will be taken hereafter. A few thousand tons will go at old quotations on conditions named a short time age when orders were placed. Actual sales during the past week have been moderate. All quotations are being firmly maintained. Very little important business will be closed until after the middle of January. By that time consumers will have a better understanding whether the present upward tendency is warranted by broadening demand. Basic pig has failed to respond to the upward tendency while there are no reasons for expecting an immediate demand. Foundry is stronger than it has been for months and furnace stocks are low. No. 3 foundry is still under active inquiry and it is stated that Southern furnaces have again secured some business which local makers bid on, but their price was a little too high. Mills are inquiring freely for forge iron and makers hope to book some orders that will carry their customers well into the spring. Today's quotation for basic is $14.25; No. 2 X foundry $14.75@15; while fairly good brands of gray forge sold at $14.25 per ton.

Steel Billets—Steel billets were nominally advanced a few days ago but so far as inquiry goes no sales have been closed at the advance.

Bars—Favorable reports from nearly all bar mills today indicate a heavier demand for later delivery but only the usual scattering demand for immediate delivery. Common iron at present is under better inquiry than it has been for months.

Sheets—The business of the past week is confined to closing up orders under recent consideration. At present there are only a few scattering inquiries for large quantities and manufacturers when it comes to the point show a yielding disposition.

Pipes and Tubes—The market has been unusually quiet.

Plates—The heavy orders in western markets have toned up quotations in eastern mills on small orders; actual advances amounting to $2 a ton are easily obtained. The heavy business in hand made manufacturers firm on the average run of orders, especially from 30 to 60 days delivery.

Structural Material—Some large orders have reached the Pennsylvania structural mills for bridge, car and general construction work. An influx of orders is counted on for January.

Scrap—Scrap holders have been offering large stocks of yard scrap at apparent concessions, but the mills are not buying as freely as a short time ago. The favorable weather has permitted the accumulation from country sources of an unusual amount of scrap.

Pittsburg

Dec. 26—On account of the holidays, the past week has seen a reduction in the contracting for steel products, business having been very light in this direction. On the other hand, the near approach of the end of the year has brought heavy specifying on low-priced contracts which expire with the year. Today's mail of the steel companies was fairly good through its containing so much of this sort of business.

Pig Iron—The Youngstown Sheet & Tube Co.'s purchase of 25,000 tons of bessemer iron from the Ohio Iron & Steel Co., for early delivery, was at the regular price of $14.25, furnace, but it is now reported that a sale of an equivalent tonnage of iron ore was made by the steel company to the furnace interest, presumably at the 25c. cut price which has been made in a number of ore transactions, the open-season price not having been well maintained this year. Basic iron has been very quiet since the Jones & Laughlin Steel Co.'s purchases, but the regular asking price of furnaces is $12.50, Valley. Interest in foundry iron has largely died out. There was heavy contracting several weeks ago and while this did not cover all the consumption, the foundries which did not cover show no disposition to do so at this time. We quote: Bessemer, $14.25; basic, $12.50; No. 2 foundry, $12.50; malleable, $12.75; forge, $12.50, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—Representatives of the English syndicate are quoting $41, Baltimore, following the recent withdrawal of the $38.50 price. The new price has not been paid on any important tonnage, nor has a definite cut price been established, as consumers covered well before the advance. It is asserted in some quarters that the $38.50 price was shaded by 25c. a ton almost up to the last moment, by a concern understood to be a direct representative of one of the English producers, and the question is whether the new price will also be shaded. We quote prompt and forward at $41, Baltimore, asked.

Steel—All the steel mills have received liberal specifications and are well filled up on billets and sheet bars, the market having advanced to about $19.50, Pittsburg, for billets and $20.50, Pittsburg, for sheet bars, with Youngstown mills sometimes giving away their freight advantage over

Pittsburg in their own territory. There has been considerable contracting for rods at $24, Pittsburg, and later at $24.50. The market is quotable at the moment at $24.50@25, Pittsburg, but it is predicted that when all contracts are closed the $24.50 price will disappear.

Sheets—The sheet market has been steadily firming up to the basis announced a fortnight ago by the American Sheet & Tin Plate Co., and practically all the lower prices have now been withdrawn, effecting a total advance in two or three weeks of from $2 to $3 a ton. Specifications have been a trifle heavier than formerly, but the advance has been due chiefly to the mills realizing that the former prices were practically profitless, while in some cases it is believed they actually involved loss. A great deal of contract business is on books, and largely at the low prices, though the lowest prices of all were made only for early deliveries. We now quote, Pittsburg: Black sheets, 28 gage, 1.90c.; galvanized, 2.90c.; blue annealed, 10 gage, 1.40c.; painted corrugated, $1.30 per square; galvanized, $2.45 per square.

St. Louis

Dec. 27—The pig-iron market in St. Louis has been brighter, though the holidays have, of course, slowed things up somewhat. Some fair-sized inquiries have been received, and a few contracts closed. Prices seem to be stiffening up a little, though $10, Birmingham, or $13.75, St. Louis, is still the current figure. There is not much demand for Northern iron this week. Sellers anticipate a much better market after the first of the year.

Iron Ore Trade

L. E. Lunn and others have applied to the Interstate Commerce Commission for a reduction of ore rates on the Great Northern R.R. from Mesabi points to Superior to 40c. per ton, claiming that present rates are too high. The Duluth, Missabe & Northern and the Duluth & Iron Range recently reduced the ore rate to Duluth from 80 to 60c. Both those roads are entirely in Minnesota, and therefore not under the jurisdiction of the Interstate Commission.

Imports and exports of iron ore in the United States, 10 months ended Oct. 31, long tons:

	1910	1911	Changes
Imports	2,219,488	1,534,811	D. 684,677
Exports	611,648	708,163	I. 96,515

Imports this year included 961,099 tons from Cuba, 183,491 from Sweden, 183,382 from Spain, 142,553 from Newfoundland, 40,224 from Canada, and 24,002 tons from other countries.

Imports of manganese ore for the 10 months were 216,827 tons in 1910, and 159,979 in 1911; decrease, 56,848 tons.

Imports of iron ore into Great Britain 11 months ended Nov. 30 were 6,415,595 long tons in 1910, and 5,850,335 in 1911; decrease, 565,260 tons. Imports of manganese ores were 453,981 tons in 1910, and 332,361 in 1911; decrease, 121,620 tons.

FOREIGN IRON TRADE

German Iron Production—The German Iron & Steel Union reports the production of pig iron in November at 1,313,896 tons, being 21,045 tons less than in October. For the 11 months ended Nov. 30, the production was, in metric tons:

	1910	1911	Changes
Foundry iron	2,677,987	2,779,408	I. 101,421
Forge iron	593,436	475,303	D. 118,133
Steel pig	1,245,160	1,577,528	I. 332,368
Bessemer pig	440,441	337,965	D. 102,476
Thomas(basic)pig	8,529,217	8,986,382	I. 457,165
Total	13,486,241	14,156,586	I. 670,345

Total increase, 5 per cent. Steel pig includes spiegeleisen, ferromanganese and all similar alloys.

German Foreign Trade—Exports and imports of German Empire, 10 months ended Oct. 31, metric tons:

	Exports	Imports	Excess
Iron and steel	4,379,642	489,543	Exp. 3,890,099
Machinery	380,285	65,793	Exp. 314,492
Total	4,759,927	555,336	Exp. 4,204,591
Total, 1910	4,322,122	520,530	Exp. 3,801,592

Increase in exports this year, 437,805 tons, or 10.1 per cent.; increase in imports, 34,806 tons, or 6.7 per cent.

METAL MARKETS

New York, Dec. 27—The markets have been comparatively quiet, broken as they were by two days holiday here and three days in London.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Nov. 1911	$13,941,093	$ 3,458,321	Exp. $10,482,772
" 1910	1,376,011	4,313,500	Imp. 2,937,489
Year 1911	36,188,397	52,737,854	Imp. 16,549,457
" 1910	57,444,422	54,245,886	Exp. 3,198,536
Silver:			
Nov. 1911	5,052,238	3,338,956	Exp. 1,713,282
" 1910	5,265,595	4,827,254	Exp. 438,341
Year 1911	59,667,286	40,439,844	Exp. 19,227,442
" 1910	51,299,913	41,479,718	Exp. 9,820,195

Exports from the port of New York, week ended Dec. 23: Gold, $95,283; silver, $875,300, chiefly to London. Imports: Gold, $138,917; silver, $97,486, from Mexico and the West Indies.

Gold—Prices of gold on the open market in London were at the normal level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Some gold was taken for India and a little for Berlin; but most of the supplies went to the Bank of England.

Iridium—The price remains unchanged, at $64 per oz. for pure metal.

Platinum—The market is rather quiet, as is usual at the end of the year. Prices are unchanged. Dealers ask $46 per oz. for refined platinum and $48.50 per oz. for hard metal.

Our Russian correspondent writes, under date of Dec. 7, that the market is dull and inactive. Notwithstanding the cold weather the *starateli* are still working the sands in the Ural, and the offerings of small lots are considerable for the season. Quotations for crude platinum, 83 per cent. metal, are 10 rubles per zolotnik at Ekaterinburg and 38,500 rubles per pood at St. Petersburg; equal to $37.60 and $37.77 per oz., respectively. Demand from abroad is unchanged.

Silver—The position of silver is becoming more normal. Futures have advanced to ⅛d. over spot, and at this writing silver seems to be firm at 25 1/16d. in London.

SILVER AND STERLING EXCHANGE

Dec.	21	22	23	25	26	27
New York	54⅜	54⅛	54⅜	....	54¼	54⅜
London	25 1/16	25⅛	25 1/16	....	....	25 1/16
Sterling Ex.	4.8630	4.8630	4.8625	....	4.8625	4.8605

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Shipments of silver from London to the East, Jan. 1 to Dec. 14, reported by Messrs. Pixley & Abell:

	1910	1911	Changes
India	£6,835,500	£8,542,000	I. £1,706,500
China	1,373,500	990,300	D. 383,200
Total	£8,209,000	£9,532,300	I. £1,323,300

India Council bills in London averaged 16.06d. per rupee for the week.

Copper, Tin, Lead and Zinc

NEW YORK

Dec.	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
21	14⅛ @14¾	13.90 @14.00	44¾	4.45	4.32½ @4.35	6.20 @6.30	6.05 @6.15
22	14⅛ @14¾	13.90 @14.00	44¾	4.45	4.32½ @4.35	6.20 @6.35	6.05 @6.20
23	14⅛ @14¾	13.90 @14.00	44¾	4.45	4.32½ @4.35	6.20 @6.35	6.05 @6.20
25	.....	.....	.....	.....	.....	.....	.....
26	14⅛ @14¾	13.95 @14.05	44¾	4.45	4.32½ @4.35	6.20 @6.35	6.05 @6.20
27	14⅛ @14¾	13.95 @14.05	45	4.45	4.32½ @4.35	6.20 @6.35	6.05 @6.20

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market; for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Dec.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
21	63 1/16	63 1/16	67 1/16	205 1/4	192 1/4	15 3/4	26 5/8
22	63 1/16	64	67 1/16	205	190 3/4	15 11/16	26 3/4
23	.....	.....	.....	.....	.....	.....	.....
25	.....	.....	.....	.....	.....	.....	.....
26	.....	.....	.....	.....	.....	.....	.....
27	63 3/4	64 5/8	67 3/4	206	191 3/4	15 13/16	26 3/4

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—While it is reported that some heavy orders were placed on part of domestic consumers during the close of the last calendar week, the fact remains that the market for home trade has been relatively quiet and the bulk of the business has again come from Europe, where the demand appears to continue large. However, the business in the week of Dec. 21-27 has not aggregated so large as in the previous week. On Dec. 21 there was a sharp rise in price and during that and two following days business in electrolytic was done at 14⅛c., delivered, usual terms, while some sellers raised their asking price to 14¼c., delivered, and the stiffening became more general after the holiday. Actual business upon that basis has not yet been reported, however, and all along there have been some sellers at concessions. Indeed, the demand for near-by copper has been rather slow, while there appear to be good supplies available for such delivery. In general, however, the agencies are well booked into March and are now interested in placing contracts further ahead, for which the higher prices are asked. There does not seem to have been much interest in Lake copper during the last week, although the price has been advanced in sympathy with electrolytic, and on Dec. 27 the price asked for the premier brand was raised to 14⅜c. The close is firm at 14¼@14⅜c. for Lake copper, and 13.95@14.05c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 13¾@13⅞c. for the week.

The standard market reacted on Thursday, but on Friday the tone was somewhat firmer, and the close is cabled at the highest price, £63 15s. for spot, and £64 12s. 6d. for three months.

Copper sheets are 19@20c. base, for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 15¼c. base, carload lots at mill.

Copper exports from New York for the week were 5900 long tons. Our special correspondent gives the exports from Baltimore at 2742 tons.

The Anaconda will immediately begin to increase its production to the rate of about 26,000,000 lb. per month.

The Granby has resumed production.

The Mason Valley smeltery will shortly become a producer.

The Navy Department order for 490,000 lb. Lake copper has been awarded to the Nassau Smelting & Refining Works at 13.94c. per lb. Bids ranged from that figure up to 14⅛c., five concerns offering.

Brass Prices—The following are base prices, which took effect Dec. 21: Sheets, high brass, 15⅝c. net per lb.; low brass, 17⅛c. Wire, high brass, 15⅜c.; low brass, 17⅛c. Rods, high brass, 15⅜c.; low brass, 17⅞c. Tubing, brazed, 20¼c.; open seam, 18⅞c. Angles and channels, 19c. net per lb. Scrap allowances are 10⅛c. net per lb. for high brass and 11⅛c. for low brass.

Tin—In anticipation of the triple holiday in London, the markets here and abroad were dull. The tendency on the London Metal Exchange was somewhat easier, but transactions were small. No interest was shown on part of consumers and dealers in this market, and general views are that business will be resumed only after the holidays. The close is firm at £206 for spot, and £191 15s. for three months, and 45c. for January tin in this market.

Tin output of the Federated Malay States, 11 months ended Nov. 30, was 40,237 long tons in 1910, and 39,807 in 1911; decrease, 430 tons.

Lead—The market is unchanged at 4.45c., New York, and 4.32½@4.35c., St. Louis.

The London market is somewhat firmer, the close being cabled at £15 16s. 3d. for Spanish lead, and £15 18s. 9d. for English.

Spelter—There appears to be a little more inquiry for December and January shipment, but transactions have been of small proportions, and future deliveries remain neglected, although offers of such are made at attractive prices. A small tonnage of January-February spelter was reported sold at 6.10c., St. Louis, while some transactions in spot metal were made at around 6.20c. The spread between terms for immediate and later delivery seems to be reappearing. We quote the market at 6.20@6.35c., New York, and 6.05@6.20c., St. Louis.

The London market is higher at £26 15s. for good ordinaries, and £27 for specials.

Base price of zinc sheets was reduced ¼c. on Dec. 27 and is now $8 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Zinc dust is quoted at 7⅜c. per lb., New York.

The American Lead, Zinc & Smelting Co. has removed its general offices from Boston, Mass., to St. Louis, Mo. H. S. Kimball, president of the company, and W. F. Rossman, manager of the smelteries, will make their headquarters at the St. Louis office.

The first smelting furnace at the new works of the Bartlesville Zinc Co., at Collinsville, Okla., was put in operation on Dec. 18, at which date the time elapsed since the beginning of construction of the work was only five months. This is, so far as we are aware, the best on record in the construction of zinc-smelting works.

Other Metals

Aluminum—Business has been very dull this week and prices are off. Metal has been freely offered, with few sales. Quotations are 18½@19c. per lb. for No. 1 ingots, New York delivery.

The foreign market is inclined to be steadier. The latest London quotation is £55@57 per ton; equal to 12.17c. per lb., average.

Antimony—Business has been fair, and prices are unchanged. Cookson's is quoted at 7¾@7⅞c. per lb., and Hallett's at 7⅜@7⅝c., while 6¾@7c. is named for Chinese, Hungarian and other outside brands.

Quicksilver—The market remains quiet and prices are unchanged. The New York quotation is $44 per flask of 75 lb., with the usual advances for small lots. San Francisco, $43.50 for domestic orders and $41 for export. London price is £8 2s. 6d. per flask, with £8 quoted from second hands.

Zinc and Lead Ore Markets

Joplin, Mo., Dec. 23—The highest price paid for zinc-sulphide ore was $47 per ton, the base, per ton of 60 per cent. zinc, $40@44. Zinc silicate sold on a base of $24@26 per ton of 40 per cent. zinc. The average price, all grades of zinc, was $41.66. The highest price paid for lead was $62, the average price being $61.78 per ton.

SHIPMENTS, WEEK ENDED DEC. 23

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,252,020	. ....	1,101,840	$125,574
Joplin.....	2,532,530	.....	291,780	64,760
Galena.....	889,970	.....	189,940	24,925
Duenweg....	707,110	131,350	24,170	17,909
Cave Springs.	521,130	.....	183,600	17,675
Granby	121,390	703,840	28,590	13,305
Carl Junction	426,670	.....	.....	10,025
Miami.....	295,140	.....	75,910	6,695
Alba-Neck....	296,810	.....	.....	6,528
Spurgeon	52,570	164,840	77,880	5,695
Oronogo.....	252,170	.....	.....	4,966
Jackson.....	196,200	.....	3,960	4,335
Aurora.....	116,260	66,000	.....	3,424
Wentworth...	126,410	.....	.....	2,654
Saginaw.	.....	66,580	9,990	1,265
Lawton	58,070	.....	.....	1,220
Quapaw.....	56,270	.....	.....	1,125
Totals.....	10,900,720	1,132,610	1,987,660	$312,080
51 weeks.	492,461,290	35,600,640	89,318,870	$13,150,992
Blende val., the week, $234,346; 51 weeks, $10,053,231				
Calamine, the week, 16,319; 51 weeks, 542,000				
Lead value, the week, 61,415; 51 weeks, $2,555,761				

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1910	1911	1910	1911	1910	1911
January	$47.31	$41.85	$45.16	$40.55	$56.99	$55.68
February	40.69	40.21	39.47	39.16	53.64	54.46
March	43.60	39.85	39.71	38.45	51.26	54.57
April	41.00	38.88	39.33	37.47	49.72	56.37
May	40.19	38.25	37.51	36.79	48.16	55.21
June	40.20	40.50	37.83	38.18	48.80	56.49
July	39.63	40.75	36.80	38.36	48.59	58.81
August	40.13	42.50	37.32	41.28	49.75	60.74
September	43.45	42.63	39.96	41.29	54.73	59.33
October	43.31	42.38	40.50	40.89	53.18	54.72
November	47.20	45.40	43.20	43.25	54.80	57.19
December	42.50	.....	40.70	.....	55.70	.....
Year	$42.43	.....	$39.79	.....	$52.12	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., Dec. 23—The base price paid this week for 60 per cent. zinc ore was $43.50@44. The base price paid for 80 per cent. lead ore was $58 per ton.

SHIPMENTS, WEEK ENDED DEC. 23

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	646,610	.....	.....
Galena	521,900	.....	.....
Hazel Green	499,400	.....	.....
Benton	403,900	.....	387,000
Mineral Point	397,870	.....	.....
Harker	129,125	.....	.....
Highland	110,200	.....	.....
Rewey	77,860	.....	.....
Shullsburg	.....	116,000	.....
Linden	.....	.....	60,000
Cuba City	.....	.....	81,180
Total	2,786,865	116,000	528,180
Year to date	148,385,334	8,817,815	28,429,940

Shipped during week to separating plants, 1,856,000 lb. zinc ore.

Other Ore Markets

Pyrites—Domestic pyrites are sold at 12@12½c. per unit of sulphur, at mines for furnace sizes; fines are 10@12c. per unit. Imported pyrites are sold ex-ship, at 12@13½c. per unit, for lump and furnace sizes; arsenical pyrites at 12½@12¾. Imported fines are 12½c. per unit, ex-ship, for non-arsenical, and 12c. for arsenical. Most of the imported pyrites come from Spain.

CHEMICALS

New York, Dec. 27—The general market is quiet, with very little doing over the holidays.

Copper Sulphate—A fair business is being done at the advanced prices. The quotations remain at $4.90 per 100 lb. for carload lots and $5.15 per 100 lb. for smaller parcels.

Arsenic—Spot supplies are rather better, but the market is dull and quiet. Quotations are lower, $2.25 per 100 lb. being asked for white arsenic.

Nitrate of Soda—Business has been rather quiet, and no improvement is looked for until January. Current quotations are 2.20c. per lb. for both spot and future positions.

Petroleum

Exports of mineral oils from the United States, 11 months ended Nov. 30, in gallons:

	1910	1911
Crude petroleum	107,476,300	109,423,802
Naphthas	70,986,817	105,297,739
Illuminating oils	854,154,150	1,010,376,253
Lubricating and paraffin	146,192,506	159,182,309
Residuum	103,199,240	107,476,565
Total	1,282,009,013	1,491,756,668

Total increase this year, 209,747,655 gal., or 16.4 per cent.

MINING·STOCKS $

New York, Dec. 27—The course of the general stock market early in the week was rather confused and irregular. One or two special stocks—like Lehigh Valley—advanced, but others were weak. This tendency was rather increased by the holiday from Friday over to Tuesday.

On the Curb the course of mining stocks was very much the same as on the Exchange. Prices were rather irregular and trading slow. After the holiday matters were much the same. Some degree of activity developed in the copper stocks, Inspiration and Greene-Cananea being the chief issues traded in. Butte Coalition seems to have quieted down. In the Cobalt stocks, there was some demand for Nipissing at a fractional advance, but other stocks were quiet.

Sales of Homestake Mining were reported at $86.75@87.50 per share.

Boston, Dec. 26—The further advance in the price of the metal has stimulated the copper-share market, although the holiday period tended to detract from prevailing conditions. The year is going out with excellent prospects for a big, broad and active market for copper shares.

The most important news of the week is the virtual wiping out of the Butte Coalition and Parrot Copper mining companies by the distribution of their assets. This gave these securities a broad and active market, particularly the first named. Butte Coalition's treasury assets consist of 517,655 shares of Anaconda, 3000 shares of International Smelting and about $4,000,000 cash. The result has been a $3.37½ advance in the price of the stock to $23.25.

Parrot directors have voted to distribute 90,000 shares of Anaconda, in exchange for which its properties were sold and about $910,000 of cash assets were turned over to Anaconda 2½ years ago. Parrot stock rose $2.50 to $14.50 on the strength of ithis announcement. The Inspiration-Live Oak merger terms are also announced, which stimulated Live Oak particularly.

A feeling of optimism pervades the whole market. Calumet & Hecla and Wolverine showed the most pronounced advances, the former rising $29 to $449, and the latter $7 to $102. Ahmeek on the Curb rose $15 in its bid price to $240 per share. Arizona Commercial, new stock, with $1 assessment paid, has been active up to $2.68¾ per share.

Curb trading has been more active, with a generally firm tone outside of

COPPER PRODUCTION REPORTS.

Copper contents of blister copper, in pounds.

Company	Sept.	October	Nov.
Alaska shipments	2,807,240	2,704,802	1,274,655
Anaconda	21,565,800	21,400,000	20,850,000
Arizona, Ltd.	2,544,000	2,720,000	2,960,000
Balaklala	.....	.....	.....
Copper Queen	6,546,540	7,786,218	6,946,775
Calumet & Ariz.	4,198,000	4,784,000	4,390,000
Detroit	1,864,050	2,086,624	1,941,498
East Butte	1,134,000	920,000	983,405
Mammoth	1,751,327	1,865,846	1,793,181
Nevada Con.	5,328,983	5,547,931	5,207,983
Old Dominion	2,032,000	2,050,000	2,082,000
Shannon	1,550,080	1,124,000	.....
South Utah	266,000	326,578	361,681
United Verde*	2,750,000	2,750,000	2,500,000
Utah Copper Co.	9,285,381	8,660,729	9,117,961
Lake Superior*	18,500,000	18,440,000	18,600,000
Non-rep. mines*	14,748,673	15,634,000	14,000,000
Total production	96,872,674	98,800,728	.....
Imports, bars, etc.	26,679,736	22,960,027	.....
Total blister	123,552,410	121,760,755	.....
Imp. in ore & matte	6,408,799	4,137,431	.....
Total	129,961,209	125,898,186	.....
Brit. Col. Cos.:			
British Col. Copper	875,023	778,586	.....
Granby	.....	.....	.....
Mexican Cos.:			
Boleo	2,094,400	1,245,440	.....
Cananea	.....	5,804,000	.....
Moctezuma	2,112,683	1,719,643	1,682,768
Other Foreign:			
Cape Cop., S. Africa	.....	.....	.....
Spassky, Russia	759,360	672,000	.....
Exports from:			
Chile	4,816,000	4,816,000	4,704,000
Australia	6,496,000	7,056,000	7,168,000

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.
*Estimated.

STATISTICS OF COPPER

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export
XI, 1910	119,353,463	60,801,992	67,424,316
XII	123,339,219	43,594,018	88,104,075
Year 1910	1,452,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,567	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,936,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279

VISIBLE STOCKS.

	United States.	Europe.	Total.
XII, 1910	130,389,069	193,200,000	323,589,095
I, 1911	122,030,195	236,629,120	358,649,373
II	142,439,490	236,992,000	379,431,134
III	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

Rhode Island Coal, which broke from $1.68¾ to 81c. This company has got to undergo reorganization and an assessment. Corbin Copper, First National and Butte Central have been the notably strong and active features.

Assessments

Company	Delinq	Sale	Amt
Arizona Commercial, Ariz.	Dec. 11	.....	$1.00
Belcher, Nev.	Jan. 3	Jan. 24	0.10
Black Jack, Utah	Feb. 6	.....	0.01
Bruns. C. V. M., Nev.	Jan. 12	Feb. 2	0.02
Bullion, Nev.	Jan. 12	Jan. 29	0.05
Caledonia, Nev.	Dec. 11	Jan. 2	0.10
Chollar, Nev.	Jan. 3	Jan. 26	0.10
Confidence, Nev.	Jan. 16	Feb. 6	0.20
Con. Imperial, Nev.	Jan. 16	Feb. 7	0.01
Con. Virginia, Nev.	Dec. 16	Jan. 6	0.25
Hancock Con., Mich.	Jan. 10	.....	1.00
Julia, Nev.	Dec. 28	Jan. 16	0.05
Kentuck Con., Nev.	Jan. 9	Jan. 26	0.05
Ojibway, Mich.	Jan. 10	.....	1.00
Overman, Nev.	Dec. 13	Jan. 3	0.05
Raven, Mont.	Feb. 1	.....	0.10
San Antonia, Mex.	Nov. 20	.....	0.50
Scorpion, Nev.	Dec. 12	Jan. 3	0.02
Smuggler, Utah	Jan. 10	Jan. 10	0.002½
Southwestern Miami, Ariz.	Jan. 15	.....	1.00
Spider, Utah	Jan. 15	Feb. 15	0.002½
Swansea, Utah	Nov. 13	.....	0.01
Utah Con. M. & M., Utah	Dec. 20	.....	0.002½
Utah Con. Tintic, Utah	Dec. 7	.....	0.01
Utah, Nev.	Jan. 19	Feb. 9	0.05
Victoria, Mich.	Aug. 21	.....	1.00
Winona, Mich.	Nov. 10	.....	1.00
Wyandot, Mich.	Dec. 14	.....	1.00

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1909.	1910.	1911.	1909.	1910.	1911.
January	51.750	52.375	53.795	23.843	24.154	24.865
February	51.472	51.534	52.222	23.706	23.794	24.081
March	50.468	51.454	52.745	23.227	23.690	24.324
April	51.428	53.221	53.325	23.708	24.483	24.595
May	52.905	53.870	53.308	24.343	24.797	24.583
June	52.538	53.462	53.043	24.166	24.651	24.486
July	51.043	54.150	52.630	23.519	25.034	24.286
August	51.125	52.912	52.171	23.588	24.428	24.082
September	51.440	53.295	52.440	23.743	24.567	24.209
October	50.923	55.490	53.340	23.502	25.596	24.594
November	50.703	55.635	55.719	23.351	25.680	25.649
December	52.226	54.428	.....	24.030	25.160	.....
Total	51.502	53.486	.....	23.706	24.670	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1910.	1911.	1910.	1911.	1910.	1911.
January	13.620	12.295	13.870	12.680	60.923	55.604
February	13.332	12.256	13.719	12.611	59.388	54.970
March	13.255	12.139	13.586	12.447	59.214	54.704
April	12.733	12.019	13.091	12.275	57.238	54.035
May	12.550	11.989	12.885	12.214	56.313	54.313
June	12.404	12.385	12.798	12.611	55.310	56.368
July	12.215	12.463	12.570	12.720	54.194	56.670
August	12.490	12.405	12.715	12.634	55.733	56.264
September	12.379	12.201	12.668	12.508	55.207	55.253
October	12.553	12.189	12.788	12.370	56.722	55.176
November	12.742	12.616	12.914	12.769	57.634	57.253
December	12.581	.....	12.863	.....	56.769	.....
Year	12.738	.....	13.039	.....	57.054	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1910.	1911.	Month	1910.	1911.
January	32.700	41.255	July	32.695	42.400
February	32.920	41.614	August	33.972	43.319
March	32.403	40.157	September	34.982	39.755
April	32.976	42.185	October	36.190	41.185
May	33.125	43.115	November	36.547	43.125
June	32.769	44.606	December	38.199	.....
			Av. Year	34.123	.....

Prices are in cents per pound.

LEAD

Mohth	New York		St. Louis		London	
	1910.	1911.	1910.	1911.	1910.	1911.
January	4.700	4.483	4.582	4.334	13.650	13.009
February	4.613	4.440	4.445	4.266	13.328	13.043
March	4.459	4.394	4.307	4.238	13.063	13.122
April	4.376	4.412	4.225	4.262	12.641	12.889
May	4.315	4.373	4.164	4.223	12.550	12.984
June	4.343	4.435	4.207	4.292	12.688	13.260
July	4.404	4.499	4.291	4.397	12.531	13.530
August	4.400	4.500	4.290	4.406	12.513	14.260
September	4.400	4.485	4.289	4.356	12·582	14.744
October	4.400	4.265	4.271	4.139	13.091	15.332
November	4.442	4.298	4.314	4.181	13.217	15.821
December	4.500	.....	4.363	.....	13.197	.....
Year	4.446	.....	4.312	.....	12.920	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1910.	1911.	1910.	1911.	1910.	1911.
January	6.101	5.452	5.951	5.302	23.350	23.887
February	5.569	5.518	5.419	5.368	23.188	23.276
March	5.637	5.563	5.487	5.413	23.031	23.016
April	5.439	5.399	5.289	5.249	22.469	23.743
May	5.191	5.348	5.041	5.198	22.100	24.375
June	5.128	5.520	4.978	5.370	22.094	24.612
July	5.152	5.695	5.002	5.545	22.406	25.006
August	5.279	5.953	5.129	5.803	22.800	26.801
September	5.514	5.869	5.364	5.719	23.165	27.750
October	5.628	6.102	5.478	5.951	23.900	27.256
November	5.976	6.380	5.826	6.223	24.083	26.795
December	5.624	.....	5.474	.....	24.019	.....
Year	5.520	.....	5.370	.....	23 050	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1910	1911	1910	1911	1910	1911
January	$19.90	$15.90	$17.98	$14.40	$17.94	$14.75
February	18.96	15.90	17.21	14.50	17.38	14.81
March	18.53	15.90	16.93	14.65	17.00	14.96
April	18.28	15.90	16.84	14.65	16.75	15.00
May	17.10	15.90	15.94	14.30	16.18	14.72
June	16.52	15.90	15.60	14.06	15.53	14.56
July	16.40	15.90	15.40	14.03	15.40	14.53
August	16.09	15.90	14.89	14.00	15.16	14.47
September	15.92	15.90	14.73	13.57	14.93	14.40
October	15.90	15.43	14.05	13.44	14.88	14.34
November	15.84	14.92	14.26	13.30	14.78	14.25
December	15.90	.....	14.15	.....	14.65	.....
Year	$17.10	.....	$15.65	.....	$15.83	.....

STOCK QUOTATIONS

COLO. SPRINGS Dec. 26

Name of Comp.	Bid.
Acacia	.04⅝
Cripple Cr'k Con.	.02½
C. K. & N.	.10
Doctor Jack Pot	.06½
Elkton Con.	.68⅜
El Paso	.68
Findlay	‡.04½
Gold Dollar	.17½
Gold Sovereign	.02½
Isabella	.14½
Jack Pot	.06
Jennie Sample	.06
Lexington	‡.01
Moon Anchor	.01½
Old Gold	.02½
Mary McKinney	.52
Pharmacist	.02½
Portland	.91½
Vindicator	.68½
Work	.02½

SALT LAKE Dec. 26

Name of Comp.	Bid.
Beck Tunnel	.14
Black Jack	.09½
Carisa	.17½
Cedar Talisman	.02½
Colorado Mining	.27½
Columbus Con.	.20
Daly-Judge	5.10
Grand Central	.68
Iron Blossom	1.00
Little Bell	.30
Lower Mammoth	.02½
Mason Valley	11.75
May Day	.19
Nevada Hills	2.30
New York	.05½
Prince Con	.78
Silver King Coal'n	1.52½
Sioux Con.	.11
Uncle Sam	.24½
Yankee	.24

TORONTO Dec. 26

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6.90	Pearl Lake	.37
Hudson Bay	80.00	Porcu. Gold	.57½
Temiskaming	.30	Porcu. Tisdale	.02
Wettlaufer-Lor	.86	Preston E. D.	.12½
Apex	.08	West Dome	.75
Central	3.25	Standard	.11½
Dobie	.80	Foley O'Brien	.48
Dome Exten	.59	Rea	1.60
Hollinger	13.51	Crown Chartered	‡.52
Imperial	.05½	Swastika	.19½

SAN FRANCISCO Dec. 26

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.01	Belmont	8.00
Belcher	.36	Jim Butler	.28
Best & Belcher	.19	MacNamara	.26
Caledonia	1.30	Midway	.19
Challenge Con.	.15	Mont.-Tonopah	.78
Chollar	.05	North Star	.23
Confidence	.40	West End Con.	.75
Con. Virginia	1.12½	Atlanta	.15
Crown Point	.50	Booth	.06
Gould & Curry	.06	C.O.D. Con.	.12
Hale & Norcross	.19	Comb. Frac.	.13
Mexican	4.37½	Jumbo Extension	.22
Occidental	.50	Pitts.-Silver Peak	1.20
Ophir	1.65	Silver Pick	.06
Overman	1.10	St. Ives	.30
Potosi	.12	Tramps Con.	.01
Savage	.33	Argonaut	‡3.40
Sierra Nevada	.30	Bunker Hill	‡3.00
Union Con.	1.17½	Cent. Eureka	.41
Yellow Jacket	.50	So. Eureka	‡6.00

N. Y. EXCH. Dec. 26

Name of Comp.	Clg.
Amalgamated	66½
Am. Agri. Chem.	63½
Am.Sm.&Ref.,com	75
Am. Sm.& Ref., pf.	103
Am. Sm. Sec., pf. B	84⅛
Anaconda	38⅜
Batopilas Min.	1⅜
BethlehemSteelpf	61⅛
Chino	26⅛
Federal M.& S., pf.	39
Goldfield Con.	5
Great Nor., ore ctf.	37½
Homestake	86¾
Miami Copper	24
Nat'nalLead,com.	54¾
National Lead, pf.	106
Nev. Consol	19⅝
Pittsburg Coal, pf.	82
Ray Con.	18¼
RepublicI&S,com.	27⅝
Republic I & S, pf.	94
SlossSheffi'd,com.	40
Sloss Sheffield, pf.	108⅜
Tennessee Copper	37⅝
Utah Copper	56⅞
U. S. Steel, com.	68⅜
U. S. Steel, pf.	111¼
Va. Car. Chem.	54⅝

N. Y. CURB Dec. 26

Name of Comp.	Clg.
Barnes King	‡.35
Beaver Con.	.42
Braden Copper	5⅞
B. C. Copper	4⅜
Buffalo Mines	1.60
Butte & Vipond	.53
Butte Coalition	23¼
Cobalt Central	.01
Con. Ariz. Sm.	⅜
Davis-Daly	1/16
Diam'field-Daisy	14
Ely Con.	3/16
Florence	.60
Giroux	4⅜
Gold Hill Con.	1/16
Greene Cananea	8½
Greenwater	.05
Guggen. Exp.	184
Inspiration	10⅛
Internat. S. & R.	‡124
Kerr Lake	2⅜
La Rose	4
McKinley-Dar-Sa.	1 11/16
Min. Co. of A. new	4
Nev. Utah M. & S.	⅛
Nipissing Mines	7⅛
Ohio Copper	1⅛
Pacific Sm. & M.	1/16
Porcupine T'nsite	.52
Precious Metals	‡1⅜
Ray Central	1⅛
Red Warrior	‡1¼
South Utah M.& S.	⅜
Standard Oil (Old)	625
Stand'd Oil of N.J.	340
Stand'd Oil Subs.	325
Stewart	.99
Tonopah	7⅜
Tonopah Ex.	1⅝
Tri-Bullion	⅛
Tularosa	‡⅜
Yukon Gold	3⅜

LONDON Dec. 27

Name of Com.	Clg.
Camp Bird	£1 10s 0d
Dolores	1 10 0
El Oro	1 3 3
Esperanza	1 11 10½
Mexico Mines	7 15 0
Oroville	0 4 9
Stratton'sInd.	0 2 0
Tomboy	1 3 9

BOSTON EXCH. Dec. 26

Name of Comp.	Clg.
Adventure	6
Algomah	5¼
Allouez	41
Am. Zinc	25¾
Ariz. Com., ctfs.	2¾
Bonanza	.40
Boston & Corbin	7⅛
Butte & Balak	4¾
Calumet & Ariz	63⅜
Calumet & Hecla	449
Centennial	16
Con. Mercur	.03
Copper Range	56⅛
Daly West	6½
East Butte	13⅜
Franklin	12¾
Granby	37½
Hancock	29
Hedley Gold	16
Helvetia	1⅛
Indiana	15
Island Cr'k, com.	42
Isle Royale	22
Keweenaw	.85
Lake	37¾
La Salle	6
Live Oak	42
Mass	9⅛
Michigan	2
Mohawk	53¼
New Arcadian	3⅞
New Idria Quick.	7¾
North Butte	28¾
North Lake	7½
Ojibway	4⅛
Old Dominion	48
Osceola	108
Parrot	14⅝
Quincy	75½
Shannon	10⅞
Shattuck-Ariz.	19½
Superior	30½
Superior & Bost.	3½
Tamarack	29
Trinity	5⅜
Tuolumne	3⅝
U. S. Smelting	37
U. S. Smelt'g, pf.	49
Utah Apex	2⅜
Utah Con.	17
Victoria	3½
Winona	6⅛
Wolverine	102
Wyandot	1¼

BOSTON CURB Dec. 26

Name of Comp.	Last
Ahmeek	240
Bingham Mines	2
Boston Ely	.72
Boswyocolo	.10½
Cactus	.16
Calaveras	1½
Chief Cons	.65
Corbin	2⅜
Cortez	1⅜
Crown Reserve	2⅞
First Nat. Cop.	2
Majestic	.43
Mazatan	⅛
Moneta Porc.	.10
Nat'l Mine & Ex.	.11
Nevada-Douglas	2½
New Baltic	6
Oneco	2¼
Raven Copper	⅛
Rhode Island Coal	.83
San Antonio	‡3½
South Lake	5½
Trethewey	.60
Union Mines	‡⅛
United Verde Ext.	⅛
Vulture	‡5½

‡Last quotation.

UNIV. OF MICH.
DEC 30 1911

December 30, 1911.

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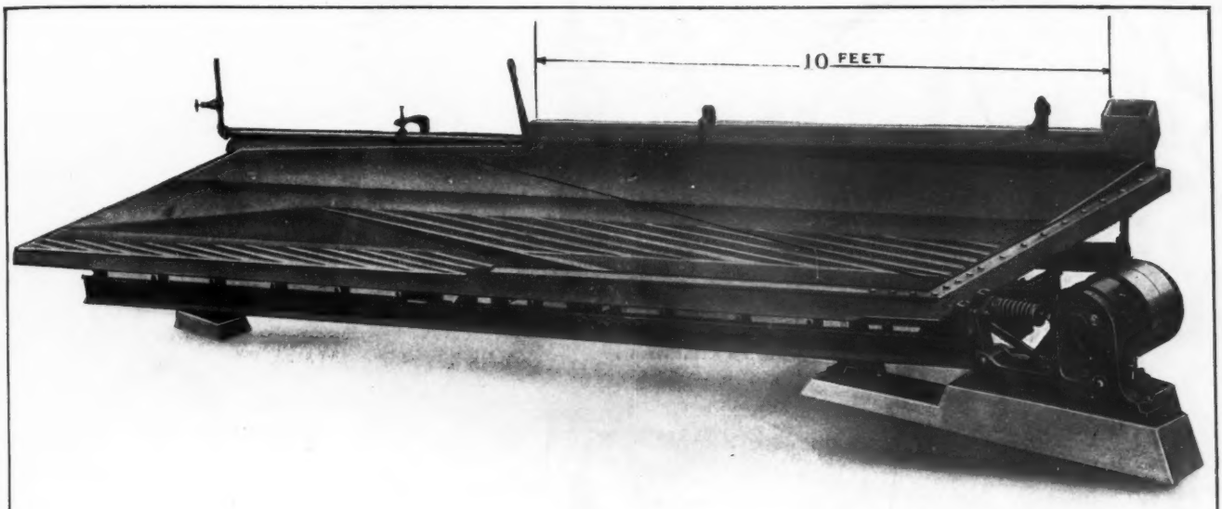


Tests Prove The Highest Efficiency Of The James Diagonal Plane Slimer

The following letter and tests made on "Cobalt Ores" speak for themselves. They prove the remarkable value of the James No. 3 Slimer. Let us study your extraction problems and submit a guaranteed statement regarding what we can do for you.

THE HUDSON BAY MINES, Limited

Main Office: COBALT, ONT., Nov. 1st, 1911

U. S. James, Esq., Newark, N. J.

Dear Sir: Enclosed please find copy of the two tests on your No. 3 Slimer. The test is very gratifying to me and will be equally so to you no doubt. The feed will all pass 200 mesh by test.

Yours sincerely, HUDSON BAY MINES, Limited.
Per *H. G. Young*, Manager

HUDSON BAY MILL

Tests On James No. 3 Slimer

Date - -	Oct. 28.	Date - -	Oct. 31.
Assay Heads -	20.5	Assay Heads -	29.5
" Tails - -	5.5	" Tails - -	7.4
" Conc's -	293.6	" Conc's -	374.9
Percent. of Ext.	74.57	Percent. of Ext.	76.42

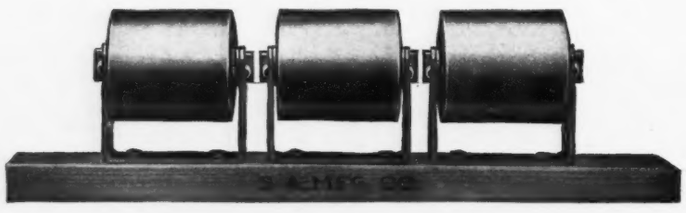
WRITE FOR CATALOG

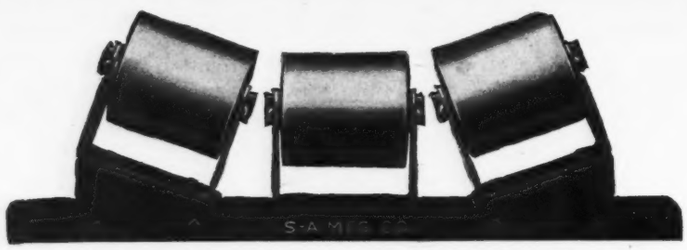
James Ore Concentrator Company

35 Runyon St. NEWARK, N. J.

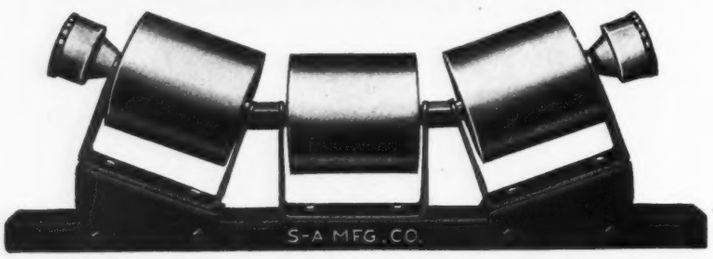
The "S-A" Unit Carrier—

the latest development in the design and construction of belt conveyors





The cuts above show special arrangements of the Ball Bearing Type Units



A convenient arrangement of the Grease Cup Type Units

The "S-A" Unit Carrier is formed of a combination of individual unit rolls, mounted on steel plate brackets. The units are exact duplicates and with various combinations all styles and sizes of carriers, may be formed. The unit carriers are adjustable to every condition and absolute flexibility is provided. As each roll has two supports, the maximum strength is secured although the carrier is of lighter weight than any other carrier of like capacity.

Two types of the Unit Carrier have been developed. In one, dust-proof ball bearings are used and each unit is entirely self-contained. In the other, special pipe connections join the hollow shafts of the units and grease cups are attached to the outer units.

Every user of belt conveyors should study the advantages of this type of carrier. Write for Bulletin EJ-12.

Stephens-Adamson Mfg. Company

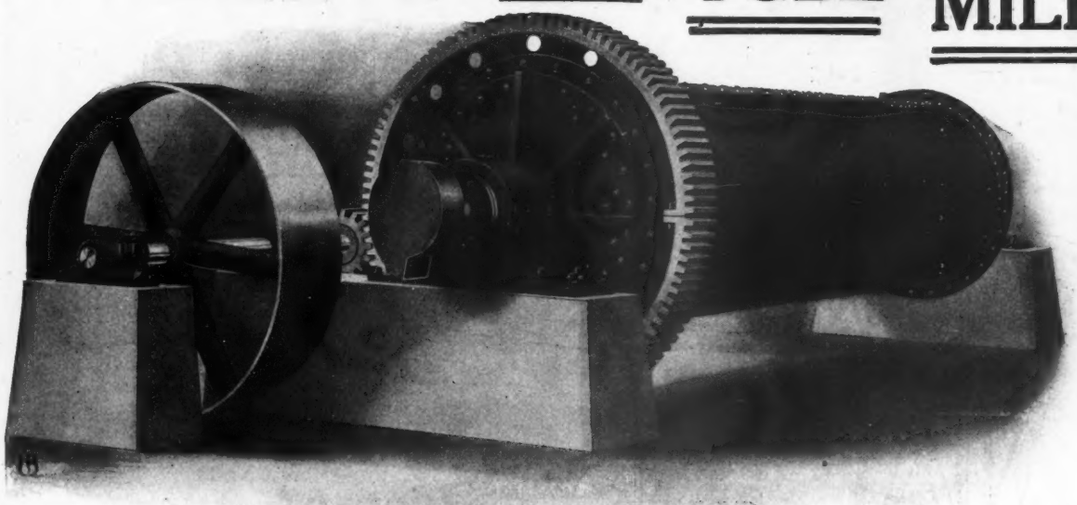
Conveying, Screening, Transmission Machinery

Aurora, Illinois

Branch Offices:

First National Bank Bldg., **Chicago**
50 Church St., **New York**
H. W. Oliver Building, **Pittsburgh**
303 Abington Bldg., **Portland, Ore.**
1204-8 Brown-Marx Bldg., **Birmingham, Ala.**
11 Fremont St., **San Francisco**
415 E. 3rd Street, **Los Angeles**

SPIRAL FED TUBE MILLS



Can You Feed Yours While It Is Running?

Our type of wet grinding tube mill embodies every possible improvement known to-day by the foremost Metallurgists and Engineers, and is made of the best material obtainable.

If you contemplate installing Tube Mills for regrinding, you should at least investigate our make of mill and get our quotations.

Standard mills are made of two sheets rolled to half circle and rivetted together with butt straps.

We also build them sectional for mule back transportation, made up of pieces so that no piece exceeds 300 pounds each; all are properly marked so as to facilitate erection.

We can furnish mills of either the trunnion or roller bearing type.

Pebbles or pieces of hard rock can be fed through the discharge end while mill is running.

When desired scoop feeder is furnished, thereby making a continuous feed—

Shells are lined with either El Oro sectional hard iron or Silex lining.

THE EVEN FEED AND CONTINUOUS OPERATION INCREASE THE CAPACITY.

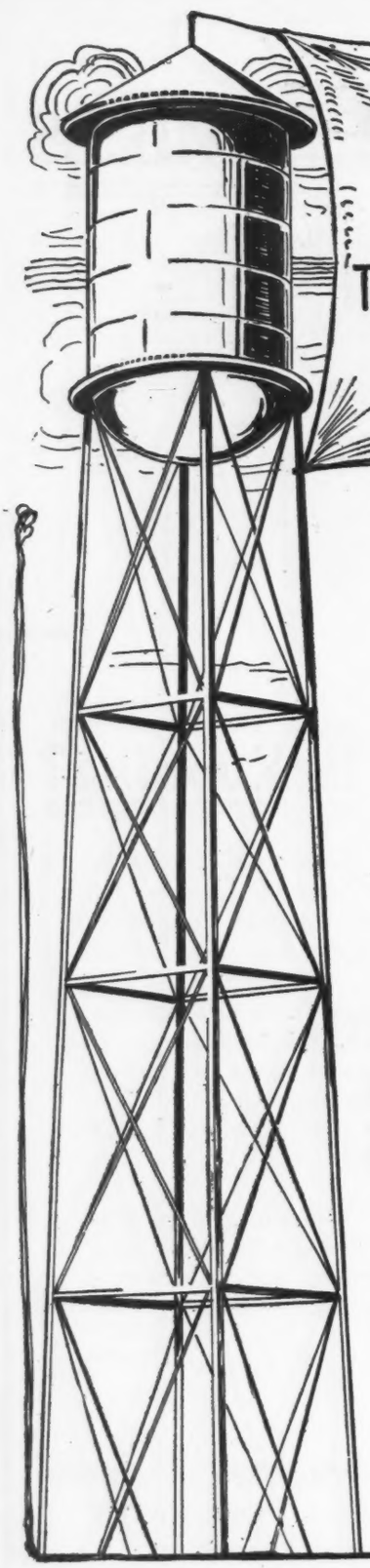
Write us giving details of your proposition; we may help you, whether it be for the treatment of ores by the Amalgamation, Concentration or Cyanide processes.

We Build

STAMP MILLS CHILE MILLS JAW CRUSHERS GYRATORY CRUSHERS
CRUSHING ROLLS HUNTINGTON MILLS FEEDERS ORE GATES
GRIZZLEYS REVOLVING SCREENS FRUE VANNERS

CHALMERS & WILLIAMS, Inc.

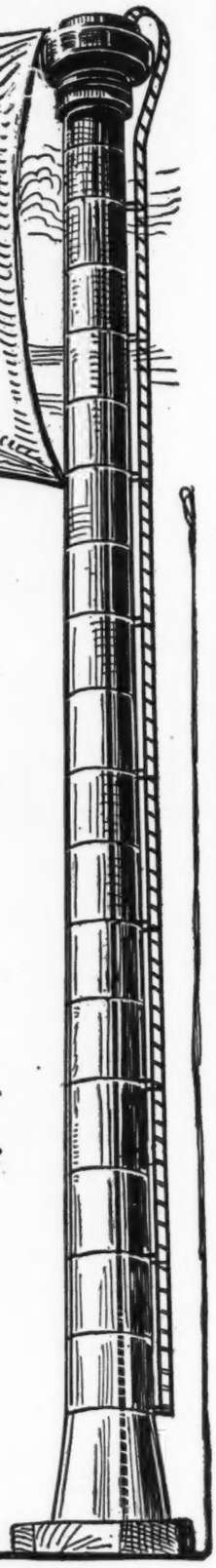
GENERAL OFFICES AND WORKS:
14th and Arnold Streets :: :: :: Chicago Heights, Ill.
New York Office: Singer Building



IRON & STEEL WORK

TANKS, STACKS & TOWERS

RIVETED PIPE ETC.



WORK OF THIS CLASS
CONTRACTED FOR IN ANY
PART OF THE
UNITED STATES
OR
MEXICO

Submit your drawings and specifications for prices, or let us know your requirements and

WE
WILL DO
THE REST

Hendrie & Bolthoff Manufacturing & Supply Co., Denver, Colo.

Steel Castings For Hoists

The demand for hoists to handle HEAVY LOADS and to operate at HIGH SPEEDS uninterrupted by costly shut-downs due to breakages is rapidly eliminating the use of cast iron for the vital parts of the machines,

Drums, Gears and Clutches should be made of

Basic Open Hearth Steel Castings

This photo shows one of 2 large Cylindro-conical Drum Shells having a large diameter of 16 ft., a small diameter of 10 ft. and a total face of 4′-2″

EACH CASTING WEIGHED 34,000 POUNDS

The Wellman-Seaver-Morgan Company

Cleveland, Ohio

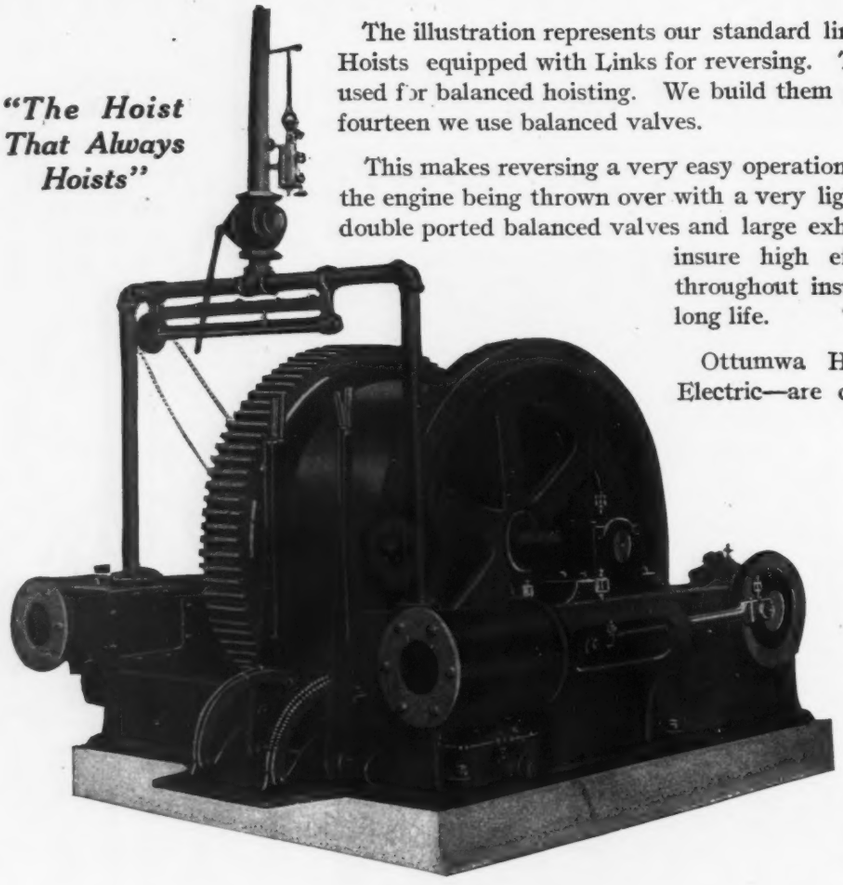
BRANCH OFFICES:

NEW YORK, Hudson Terminal DENVER, 611 Ideal Building

MEXICO, D. F., Apartado, 1220—14 a de Guerrero 3326

Reversing is easy for the Ottumwa Hoist Operator

"The Hoist That Always Hoists"



The illustration represents our standard line of Single Rigid Drum Hoists equipped with Links for reversing. These hoists are ordinarily used for balanced hoisting. We build them in all sizes; from ten by fourteen we use balanced valves.

This makes reversing a very easy operation for the Hoist Operator, the engine being thrown over with a very light effort. Well designed double ported balanced valves and large exhaust and steam passages insure high efficiency. Cut gearing throughout insures smooth running and long life.

Ottumwa Hoists—both Steam and Electric—are compact and reliable machines built to give continuous high efficiency service.

They are built on a quality basis and are as well and carefully designed as 40 years of hoist building can make them.

Write for Bulletins—particularly Bulletin No. 200 of Electric Hoists.

WE USE CUT GEARS IN ALL OUR HOISTS

OTTUMWA IRON WORKS

ESTABLISHED 1867

COMPLETE MINE EQUIPMENT

OTTUMWA, IOWA

SALES AGENTS:

Denver, Salt Lake City, El Paso, Mexico City } Mine & Smelter Supply Company

San Francisco, Los Angeles } Harron, Rickard & McCone

Butte, Montana—Anaconda Copper Mining Co.

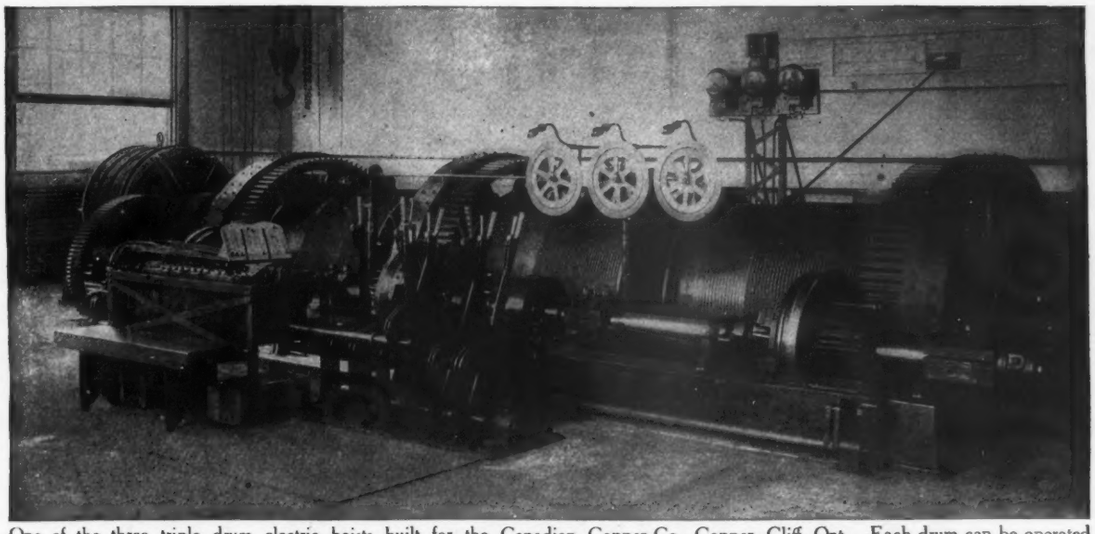
Wallace, Idaho—Cœur D'Alene Hardware Co.

Toronto, Ottawa, Cobalt, Montreal, Winnipeg, Halifax } Canada Foundry Co., Ltd.

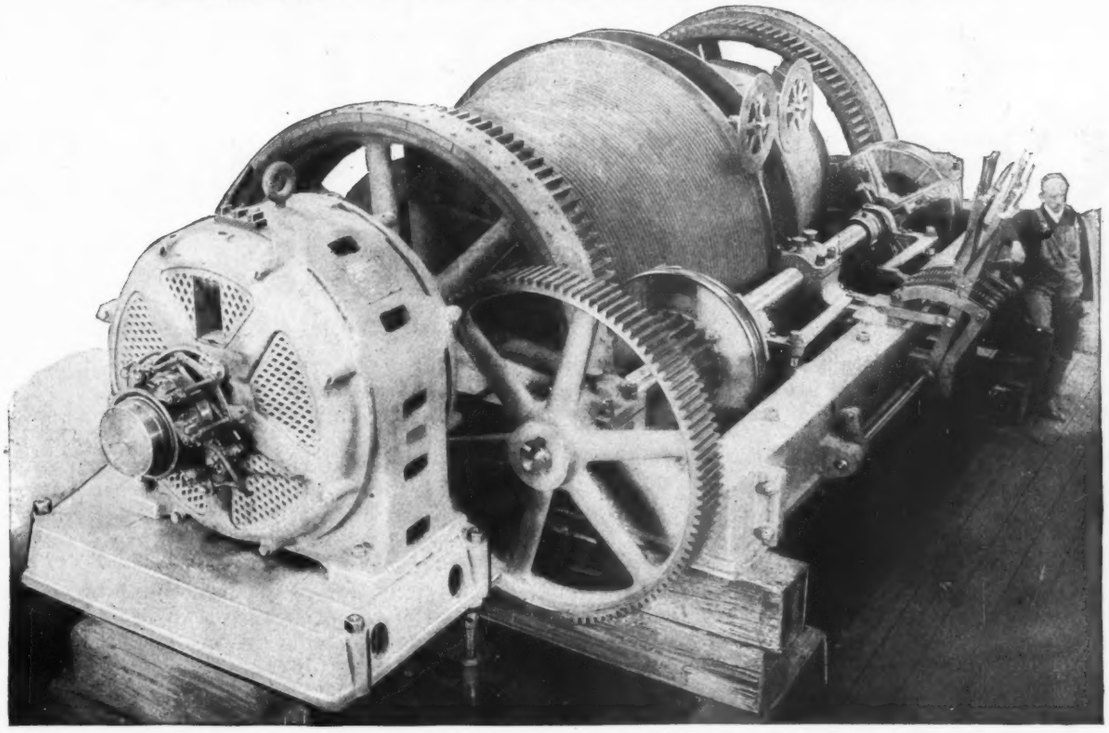
Calgary, Edmonton } Gorman, Clancey & Grindley, Ltd

Vancouver, B. C.—Robert Hamilton & Co.

ELECTRIC HOISTS



One of the three triple drum electric hoists built for the Canadian Copper Co., Copper Cliff, Ont. Each drum can be operated independently, lifting 12,000 lbs. Two drums can operate in balance. Motor 150 horsepower, 3 phase.



10,000 lbs. Capacity Hoist at the Barreno shaft of the Peregrina M. & M. Co., Guanajuato, Mexico.

THE DENVER ENGINEERING WORKS COMPANY

DENVER, COLORADO, U. S. A.

SALES AGENTS:

SAN FRANCISCO: LOS ANGELES:	Harron, Rickard & McCone for California, Western Nevada, Western Arizona.
MEXICO CITY:	Victor M. Braschi for Republic of Mexico.
SPOKANE:	Hallidie Company for Coeur d'Alene District and Eastern Washington.

78

The Lasting Service And Efficiency Of The GOODRICH CONVEYOR BELTS Is In The Quality

No conveyor system is any better than its belt. Good mechanical features are essential, but the belt determines the efficiency and service of the conveyor.

Therefore your chief consideration must be the belt.

The chief consideration of a belt is its quality.

It is quality that resists wear.

It is quality that keeps the belt together until worn out.

It is quality that keeps the belt from pulling to pieces.

It is quality that causes "Goodrich" Belts to meet wear and tear and all reasonable and unreasonable demands usually made upon belts.

It is quality and reliability that has built up our factory, the largest and best equipped in the world, and given us our business growth.

Send for a sample and test it yourself.

Test it for each of the following essentials.

Tensile strength and quality of duck.

Strength, binding power and cling of friction between the plies. Quality of cover. Test this by hammering and scraping with sharp material as well as by tensile strength and elasticity.

Notice the improved edge construction which is the outcome of years of effort to overcome edge troubles.

Finally figure for yourself the importance of the selection of the proper duck to resist the strains and the deteriorating action of moisture; proper friction, to resist breaking down through years of life; the proper cover, to have the required adhesion to the belt and the wear-resisting quality, as well as life; and above all, the proper combination of these materials and the proper construction of the belt.

Send for a sample.

The B. F. Goodrich Company

Akron, Ohio, U. S. A.

THE BALDWIN

Is the ONLY Carbide Lamp that will give the results you want

Because Our Automatic Water Feed gives Perfect Control, Positively Preventing Over Generation and Waste of Carbide

Now see how nicely we do this with our patented automatic control. Our water container is constructed (we refer to its shape, tapering at the bottom) to maintain a constant water pressure with a minimum quantity of water.

This pressure is just right to keep a correct flame, and in conjunction with our exclusive automatic control prevents waste of carbide.

Suppose an extra drop of water did get into the carbide container by jarring the Baldwin Lamp, a slight surplus of gas is generated and the pressure is increased enough to force the water back up the tube, No. 4, and hold it there until the extra gas is consumed, when the water again resumes its regular working.

This feature is found only in the Baldwin Lamp.

A miner cannot get satisfactory service from a lamp which will not of itself regulate the water feed to his movements, and give a uniform light whether he is standing still or swinging a pick.

And remember this also, if too much water is permitted to come in contact with the carbide, there is a decided waste.

JOHN SIMMONS COMPANY

102 Centre Street, New York

Branches: San Francisco, Calif. Butte, Mont. Montreal, Canada.

SAMPLE COUPON

I have not used a Baldwin Lamp, but if one is sent free of charge I will thoroughly test same.

I am superintendent of ..... Company

Signed .....

Address .....

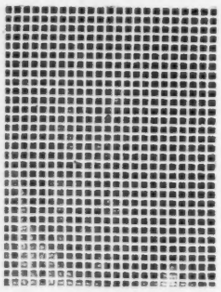
125

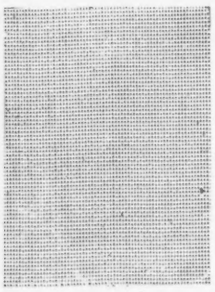
THE CALLOW SCREEN

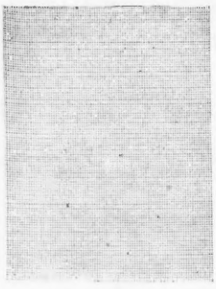
SCREENING COST SCREENING COST SCREENING COST

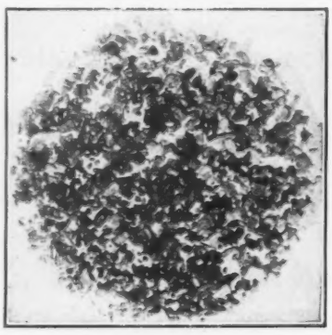
We have been furnished with the following costs of screening with the Callow Screen by one of its first users, who started screening with these machines in 1905 and has been a consistent user ever since. The Screening Medium used is Tyler's standard square mesh, brass cloth, we have never been able to convert him to Ton Cap, although we think the results would be even better were he using it.

Photographs of Screen Cloth and their oversize.

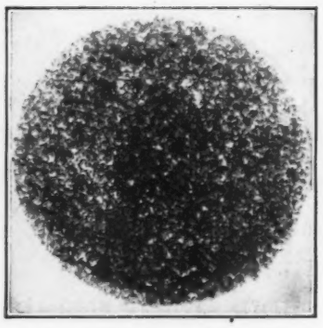




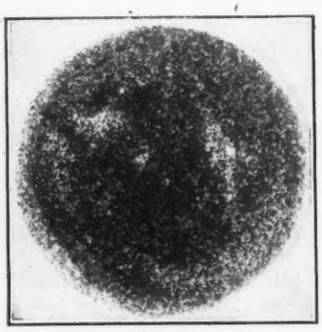




20 M. screen and its oversize



60 M. screen and its oversize



100 M. screen and its oversize

COST DATA

Mesh	Tons of feed per belt per 24 hours	Life of Belt	Total Tons Screened	Cost per ton screen cloth	Cost per ton edging	Cost per ton Total
20	45	60 days	2700	0.491c	0.16c	0.651c
60	33	90 "	2970	0.369c	0.22c	0.589c
100	15	50 "	750	3.020c	0.860c	3.880c

Or, cost per ton for screening to 3 sizes (20, 60 and 100 mesh)

45	tons per day to	20 mesh	@ 0.651c	per ton =	29.30	cents
33	" "	60 "	@ 0.589c	" =	19.45	"
15	" "	100 "	@ 3.880c	" =	58.20	"
93					106.95	cents

93 tons per day for 106.95c = 1 ton for 1.15c to 3 sizes, the finest being 100 mesh

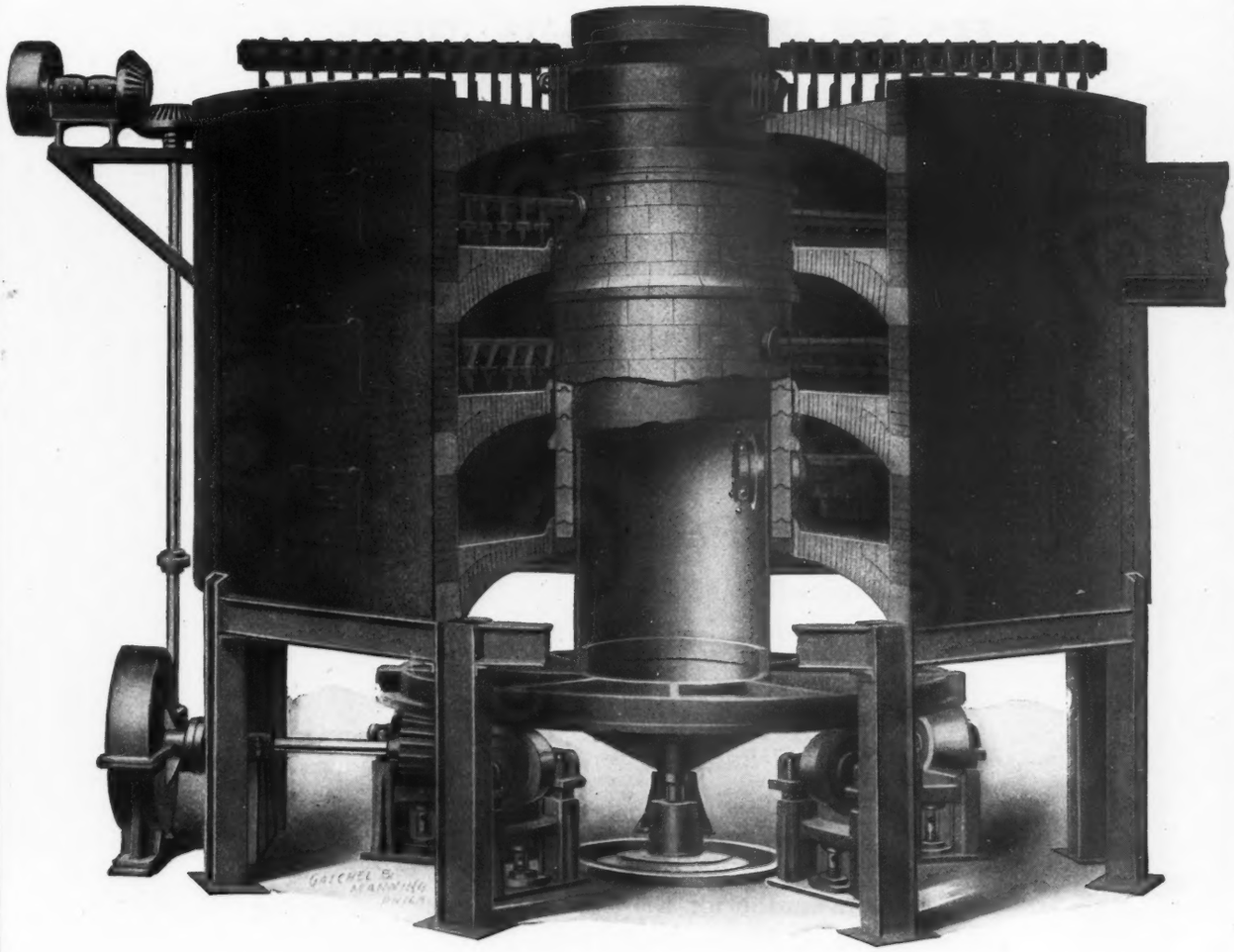
The machines were not running up to their full capacity or the costs would be even lower. Study these figures carefully; because they are full of interest to you. Do you think you could run Hydraulic Classifiers as cheaply? We doubt it and certainly screen sizing is more efficient.

THE GALIGHER MACHINERY COMPANY

Salt Lake City, Utah, U. S. A.

The Wedge Mechanical Furnace

Patented



Partial Roast And Preheating

The above furnace has many advantages over the old type of furnace for partial roast and preheating of low sulphur concentrates for treatment in reverberatories.

Write us, stating analysis of ore, concentrates or mixture you desire to roast, characteristics and physical condition of same, and number of tons to be treated per twenty-four hours.

Wedge Mechanical Furnace Company

Philadelphia, Pa.

The Catskill Aqueduct

Of The New York Water Supply

Is Being Built With

Ingersoll-Rand Machinery

An investigation of the compressor and drill equipment of the various contractors on the construction of the Catskill Aqueduct of the New York Water Supply reveals the following figures of machines in use:—

Rock Drills

Ingersoll-Rand	**967**
All "Others"	75

Air Compressors

Ingersoll-Rand	**76**
All "Others"	17

This great work (second in magnitude only to the Panama Canal) is another of the world's greatest engineering enterprises carried through with Ingersoll-Rand Machinery —the main reliance of engineers and contractors, the world over.

The merits of Ingersoll-Rand Compressors and Drills which have won them this leadership in contract work are of equal value to the mine manager and operator seeking the greatest speed, economy and reliabilty.

NEW YORK **INGERSOLL-RAND CO.** LONDON

Rock Drills Stoping Drills Hammer Drills Core Drills Electric-Air Drills Compressors

A Four Sided Drill Steel Service

There are four sides to every drill steel transaction and none can be disregarded.

First and most important, the efficiency of the steel. Second, the right *service* to the buyer.

Third, delivery promises carried out.

Fourth, fair prices.

All four sides of the question are answered in FJAB.

FJÅB is made in Sweden. From that country come many grades of steel, but we are justified in claiming that for rock drill purposes FJAB is "Sweden's Best."

FJAB is made hexagon, octagon, quarter octagon, round and cruciform in solid and hollow. It is furnished from stock or by direct importation.

Will you write us for details and prices?

A. Milne & Co.

(Established 1887)

30 Church Street, New York
8 Oliver Street, Boston, Mass.

Sole and Direct Representatives for the United States and Canada

Six Ads That Go Of The Drill

THE

PRACTICALLY *any* drill will drill rapidly and with a low cost for air and repairs *when it is new.* The rub is to get drills that will *hold* their capacity for rapid cutting on small air consumption without constant and heavy expenditures for new parts.

The valve motion of a drill—as has already been pointed out—is the *prime* factor in determining the capacity of any drill for holding its efficiency. But right along with it comes the question of what goes on *inside the cylinder* when the drill is being run.

How Its *Leather* Piston Rings Help The Holman Drill Retain Its Efficiency

The Holman Drill is the only drill offered you today in which the port arrangement is such that it is possible to use *leather* piston rings. All other drills are *compelled* to use metal piston rings.

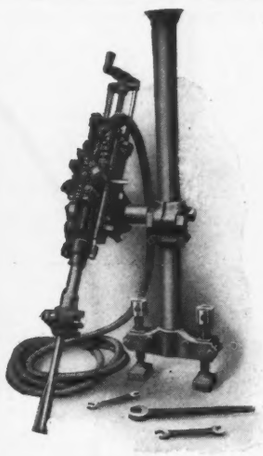
This is a very important feature. For it is one of the big reasons why the Holman Drills *hold* their ability to drill rapidly on a low air consumption and a minimum outlay for repair parts when other drills are beginning to lose that ability.

Because they are made of leather, the Holman Piston Rings pack the piston better than can possibly be accomplished with steel rings. They do not cut or shear the cylinder; they cannot break or score it.

And, in consequence, just as soon as a Holman Drill shows—in footage cut—that the cylinder action is not as positive and wasteless as it was at first, the piston rings can be easily renewed at practically no expense.

Furthermore, when the piston rings are renewed, the piston stroke will be brought back to its original sharpness and strength. For all wear that has

To The Heart Question

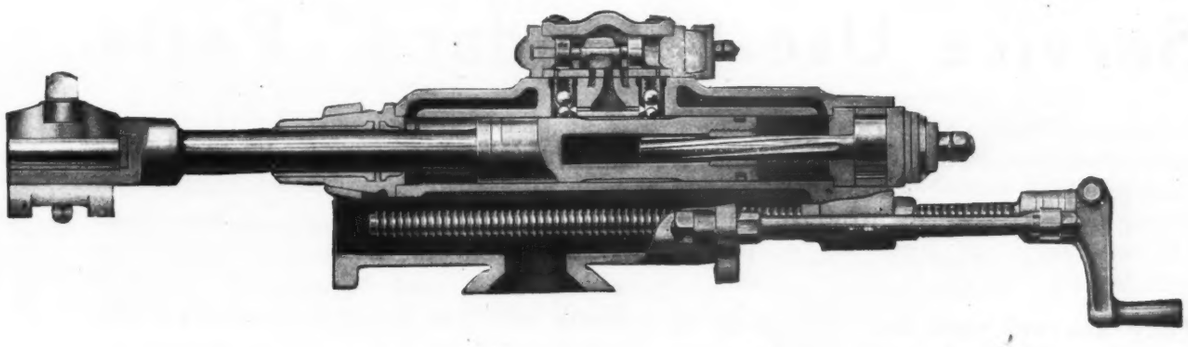


THIRD

occurred has been taken up by the leather rings—none of it by the walls of the cylinder as would have been the case had the piston rings been made of steel.

It is because of such cost-reducing, efficiency holding features as the Leather Piston Rings, the Steel Ball Auxiliary Valve (and these are but two of many) that we are able to sell the Holman Drill under the hard and fast guarantee that, over long periods, it will drill a greater footage, and at a lower cost for air and repairs than any other make of equal size.

It will pay you to get the *full* details—which can be had by going or writing to our New York Office or any one of our Branch Stores.



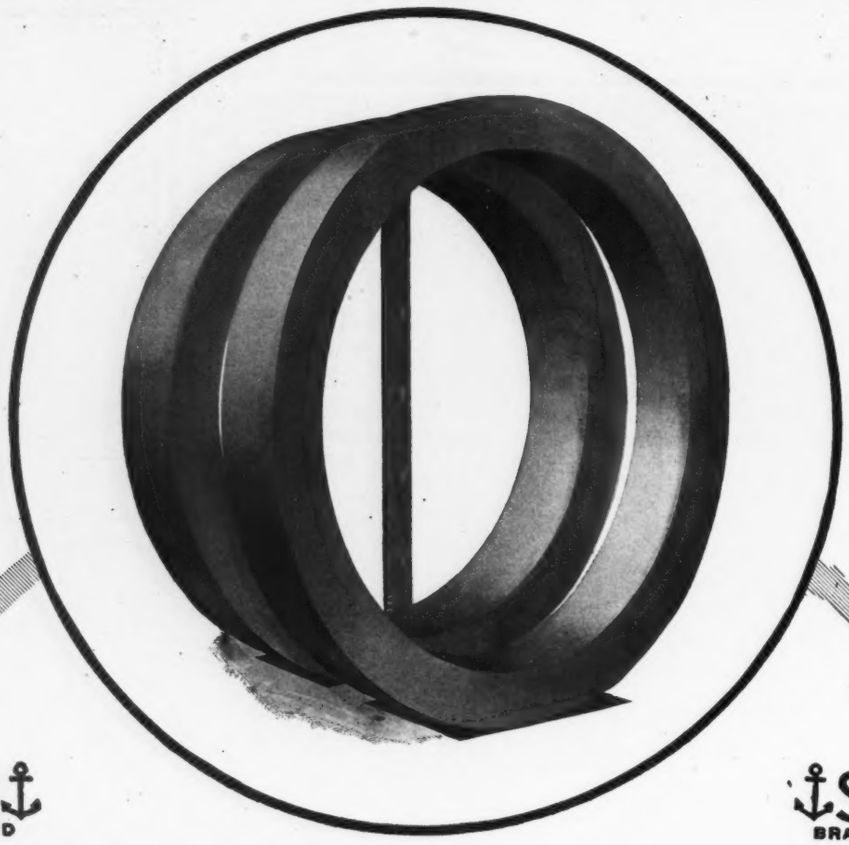
The Holman Drill—in all sizes—is carried in stock in all our Branch Stores as well as in New York. Also the Bury Air Compressor, the Holman Stretcher Bar Hoist, and a complete line of Mining and Milling Machinery, Mining, Assay and Chemical Supplies.

The MINE AND SUPPLY SMELTER COMPANY

·DENVER· SALT LAKE CITY· EL PASO ·MEXICO CITY·

New York Office, 42 Broadway

SOLE OWNERS AND MANUFACTURERS OF THE WILFLEY CONCENTRATOR



⚓S⚓ BRAND ⚓S⚓ BRAND

If You Want Economical Crusher Service Use "Standard" Parts

"Standard" parts are reducing crushing costs wherever used. They are reducing maintenance costs, freight costs and giving better results all around. Simply because they are built on a quality foundation.

They are not cast, but are made of forged and rolled steel with the same care that is used in the manufacture of our steel tires.

They are strong parts, crush the hardest kind of material, wear down evenly and require very little attention.

You need fewer parts if they are "Standard," because **they last a long time under the most severe conditions.**

If you value low upkeep cost, low operating cost, *low crushing cost*, rather than cheap first cost, "Standard" Crusher Parts will give you the desired results.

Try them, make your next crusher spares order read "Standard"—convince yourself.

Our new catalog illustrates the different roll shells, ring and dies and tires we are in position to supply—write for a copy.

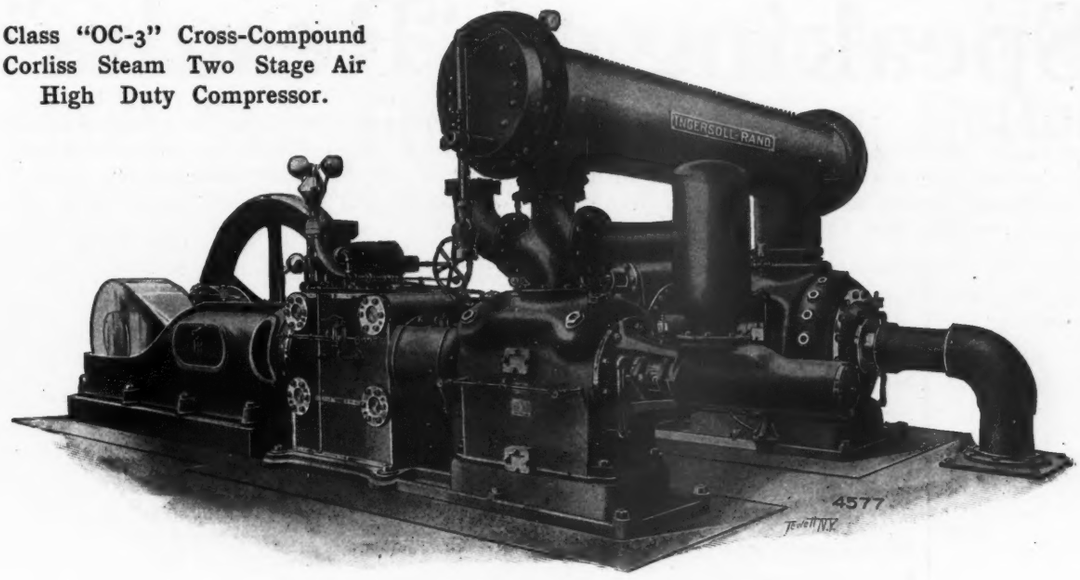
Standard Steel Works Company

Morris Building, Philadelphia, Pa.

New York, N. Y. Pittsburg, Pa. Richmond, Va. Chicago, Ill. Portland, Ore. St. Louis, Mo. Denver, Colo. San Francisco, Cal. City of Mexico, Mex.

Steel Tires, Steel Tired Wheels, Solid Forged and Rolled Steel Wheels, Steel and Iron Axles, Steel Springs, Steel and Iron Forgings, Steel and Iron Castings, Rolled Steel Rings, Steel Crusher Rolls and Shells, Steel Pipe Flanges

Class "OC-3" Cross-Compound Corliss Steam Two Stage Air High Duty Compressor.



A Saving Of $9460 Per Year

With Coal At $0.40 Per Ton Realized In A Pennsylvania Coal Mine By Installing An Ingersoll-Rand Class "OC" Air Compressor

In July, 1911, we installed a 30-inch stroke Class "OC-3" Air Compressor, of the type here illustrated, in a Pennsylvania coal mine, replacing two tandem-compound compressors of another make.

In September, 1911, the Master Mechanic's records showed the following savings resulting:—

Coal (48 tons at $0.40)	$19.20 per day.
Water (metered)	1.44 per day.
Labor	5.28 per day.
Total saving per day (24 hours)	**$25.92**
Total saving per year (365 days)	**$9460.80**

As the condenser is not yet intalled, this saving will be increased when the compressor runs condensing.

Possibly there are savings just as remarkable to be realized in your mine. Our engineers will be glad to help you investigate the question.

ROCK DRILLS **HAMMER DRILLS** **STOPING DRILLS**
CORE DRILLS **COAL CUTTERS** **ELECTRIC-AIR DRILLS**

INGERSOLL-RAND CO.

NEW YORK Offices In All Principal Cities of the World **LONDON**

Speaking of "Results"

We publish below, by permission, a reproduction of a further sample of the reports that we are constantly receiving, establishing our contention, that "trace" tailings, even in the treatment of Silver Ores, are the fashionable results with our **Type "A" or Movable method** of working The Moore Process, and further, that the "upkeep" and operating cost is but a fraction of the cost of working **our Type "B" or Stationary method.**

REPORT ON MOORE FILTER PLANT.

Name of Company: Rio Plata Mining Company

Post Office Address: Apartado 250, Chihuahua, Mexico.

Name of Mine: Santa Barbara

Name of Manager: D. W. Shanks

Type of Filter (Movable or Stationary): Movable.

Date of Erection (Original): 1908 (Additions):

Number of leaves in operation: 24

Number of leaves in reserve:

Size of leaves: 12' x 6' 6"

Capacity of plant: 85 tons dry slime per 24 hours.

Cycle: 85 minutes. { Loading 35 minutes.) Solution wash 35 minutes.) moving 10 minutes Water wash 5 minutes.)

Vacuum: 20 inches: Elevation plant above sea level: 3300

Thickness of cake: 1" to 1-1/4" inches.

Character of slime: Favorable for washing

% slime remaining on 150 mesh screen: 15

% moisture left in cake: 32 % by weight.

Soluble gold left in discharged cake: No gold in ore U. S. Cy. or Sterling per ton.

" silver " " " " : trace U. S. Cy. or Sterling per ton.

Cyanide left in discharged cake: lbs. per ton.

Cost of filtration, not including royalty.

Operation $: .035 U. S. Cy. or Sterling per ton.

Repairs $: .010 U. S. Cy. or Sterling per ton.

Frequency of acid wash, every: 60 to 90 days.

REMARKS: Heads run 32 ozs. of silver per ton.

(Name of mine owner): Rio Plata Mining Co.,
175 Fifth Ave., New York

NOTE:—It is desired to have the latest obtainable figures. If possible please state (under remarks) the period by dates during which the figures were taken.

Remember that just the **difference** in results between the Type "A" and Type "B," for about one year, more than compensates you for the small consideration we exact for the indisputable "right" to work The Moore Process in the most effective way.

Note: The treatment of silver ore slimes carrying a value of 32 ozs. per ton so efficiently that the final loss in the tailings is only a trace of silver, is a result that we have every reason to be proud of. Similar results are being obtained in the treatment of gold ore slimes by our Type "A" equipment.

The Moore Filter Company

New York, U. S. A.

Notice:—For branch offices and agencies see issue of this journal of November 4th, 1911.

You Can Be Satisfied With Anything Until You Find Something Better

That's why so many miners are now using automatically regulated acetylene mine lamps.

They bought the lamps while the automatically regulated lamp was still the best. But the miner who buys such a lamp today is behind the times for *it is no longer the best.* The Maple City Mine Lamp which adds to the feature of automatic control the exceptionally valuable feature of the Water Flow Regulator, has set a new and higher standard of mine lighting efficiency.

And Here's The Reason Why!

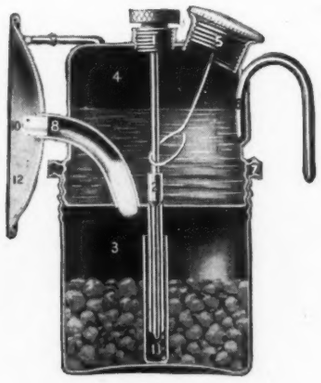
First let us explain the phrase "automatic regulation." It means that a lamp is constructed with a small tube connecting the water chamber and the carbide chamber. Through this tube is passed a wire and the clearance between the walls of the tube and the wire permits a certain amount of water to drip to the carbide. This amount is supposed to be just the correct amount to generate the correct pressure of gas to obtain best lighting efficiency.

Now here's the fallacy of this method. It would be all right if carbide had a constant quality and a certain amount of water would generate a certain amount of gas. *But it won't.*

Fresh carbide and carbide that has been properly stored do not require the same amount of water as old carbide that has not been properly stored. Large pieces of carbide are preferred by some, and these large pieces require a different feed of water than small pieces, or small and large pieces mixed and so on.

Automatic Regulation can supply only *approximately* the correct amount of water. In one case out of ten it may be right, but in the other nine it will mean *less* than the highest possible lighting efficiency.

Now in the Maple City Mine Lamp we have an automatic regulator which permits *as nearly as possible* the correct feed of water into the carbide. Then by means of the Water-Flow Regulator, the miner can quickly and easily increase or decrease the flow of water so as to obtain highest lighting efficiency without waste of carbide, at all times and regardless of the condition of the carbide.



This, while one of the most important features of the Maple City Mine Lamp, is not the only valuable feature. Why not investigate fully? We will gladly send a free trial lamp to any Mine Superintendent upon receipt of his request on a company letter head. To anyone else so desiring we will send a lamp with extra carbide container on receipt of $1.00

Send for one today

Maple City Manufacturing Co.

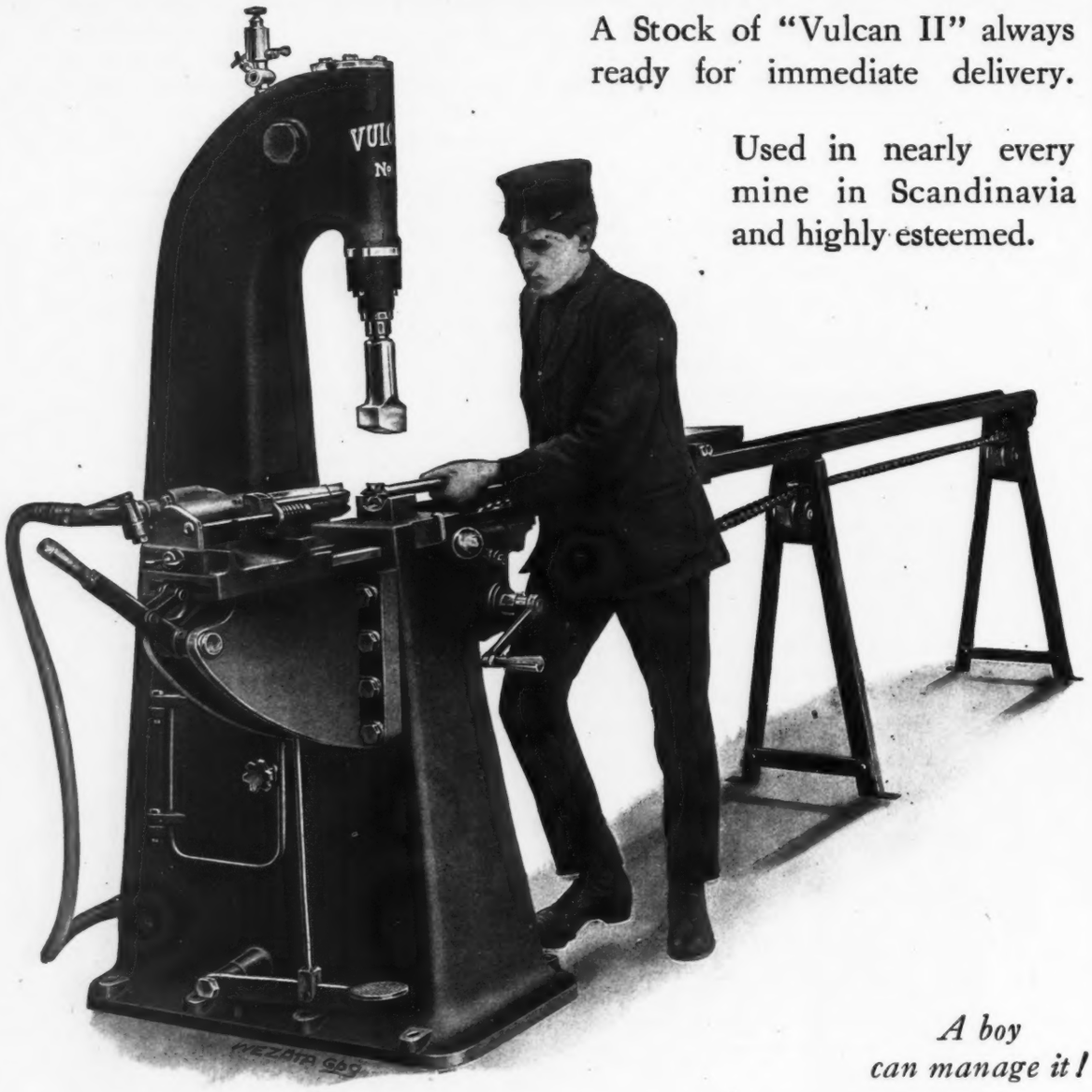
623 S. First Street **Monmouth, Illinois**

"VULCAN II"

A New Drill Maker and Sharpener, which Easily Meets the World's Competition

A Stock of "Vulcan II" always ready for immediate delivery.

Used in nearly every mine in Scandinavia and highly esteemed.

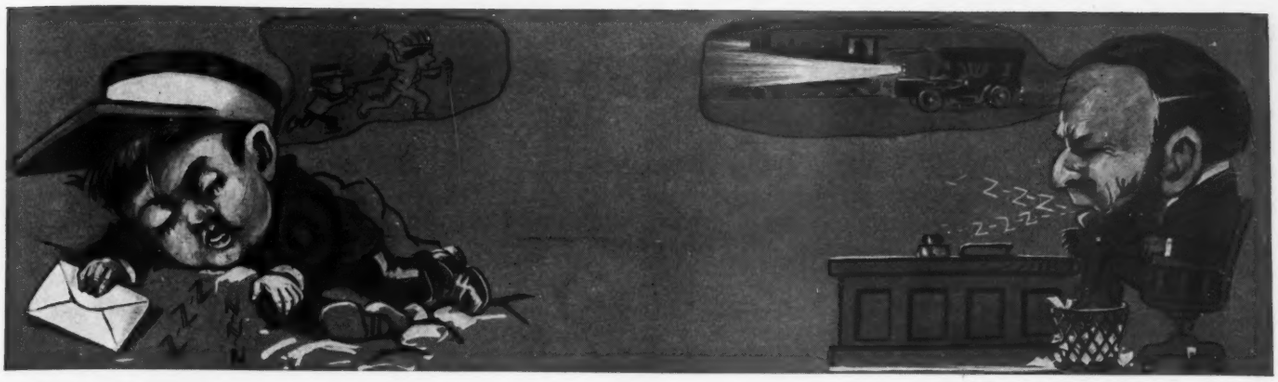


A boy can manage it!

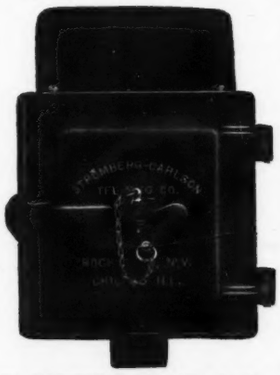
"Vulcan II" easily forges 600 new drills per day from the blank steel bars.
Drop us a line and you shall have our catalog.

"Vulcan II" manufactured by

AKTIEBOLAGET NORDISKA MOTORVERKSTÄDERNA
FINSPONG, (SWEDEN)



Your Ideas And The Messenger's Differ Radically



No. 890 TYPE, Standard Pin Lock

And in nothing more radically than speed. But there's something faster even than your ideas of speed, faster than the automobile, the locomotive or the airship and that is the

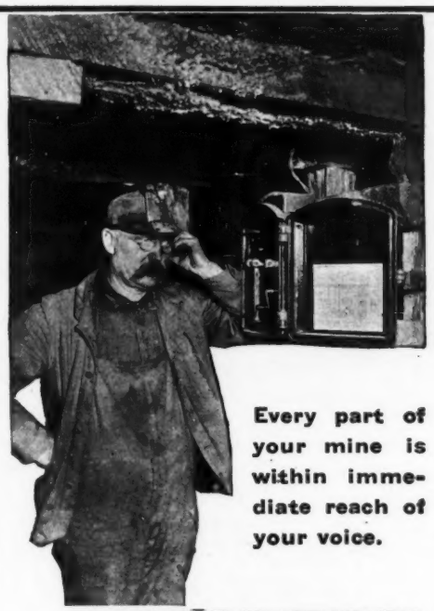
MINE-A-PHONE

For the Mine-A-Phone is instantaneous. It connects you instantly with the party you want to reach—it gives you access to all parts of the mine without delay. Be sure your mine telephone, however, is a Mine-A-Phone. It's the most practical, the most reliable, the one that's been most severely tested in actual use. Installation is comparatively inexpensive.

Write for our illustrated Bulletin No. 2500.

STROMBERG-CARLSON TELEPHONE MANUFACTURING CO.
ROCHESTER, NEW YORK, U. S. A.

Chicago, Ill. Los Angeles, Cal. Toronto, Can. San Francisco, Cal. Kansas City, Mo. Seattle, Wash.



Every part of your mine is within immediate reach of your voice.

"Send Down a New Drill to Gallery Six"

Daily Use Of The

Western-Electric

MINE TELEPHONE

cuts this foreman's delays in half, meaning greater output the greater profits for his employer.

Useful in everyday business—Indispensable in emergencies.

Ask for Bulletin No. 864 to-day.

WESTERN ELECTRIC COMPANY

Manufacturers of the 6,000,000 "Bell" Telephones

EVERY BELL TELEPHONE IS A WESTERN ELECTRIC TELEPHONE

New York, Buffalo, Philadelphia, Boston, Pittsburg; Atlanta, Chicago, Indianapolis, Cincinnati, Minneapolis; St Paul, Milwaukee, Saint Louis, Kansas City, Denver; Dallas, Omaha, Oklahoma City, San Francisco, Oakland; Los Angeles, Seattle, Salt Lake City, Portland

Montreal, Toronto, Winnipeg, Vancouver
Antwerp, London, Berlin, Paris, Johannesburg, Sydney, Tokyo

Address the house nearest you.

EQUIPMENT FOR EVERY ELECTRICAL NEED

"SAVE TIME AND FREIGHT"

"TELEPHONE OUR NEAREST HOUSE"

1860

COLORADO IRON WORKS COMPANY

ORE SMELTING EQUIPMENTS

ORE MILLING MACHINERY

1911

Complete Ore Treatment Plants

WE MAKE a specialty of building complete ore reduction plants, embodying all that is best in methods and equipment. We will contract to erect your entire mill and turn it over after demonstrating its success by regular operation.

Would it not pay you to have your mill built in this manner and be assured that its efficiency and capacity will be equal to your requirements? Would it not be to your advantage to place such a contract with a company that employs a staff of thoroughly competent engineers, that has an enviable record for successful work performed and that is abundantly able to carry out its engagements?

Colorado Iron Works Company,

Office and Works, 33rd and Wynkoop Sts., Denver, Colorado, U. S. A.

P&M P&M

Gas For Power

The Loomis-Pettibone Gas Generating System produces a clean, fixed gas absolutely free from tar. Economical in operating and maintenance cost. The fire is always in sight of the operator, permitting an even distribution of fuel. No poking is required. The patented down draft system keeps the charging floor cool and free from noxious gases. Highest efficiency. 200,000 H. P. now in successful operation.

WRITE FOR BULLETIN PM 102-16.

POWER & MINING MACHINERY CO.

WORKS: CUDAHY, WIS. New York Office: 115 Broadway

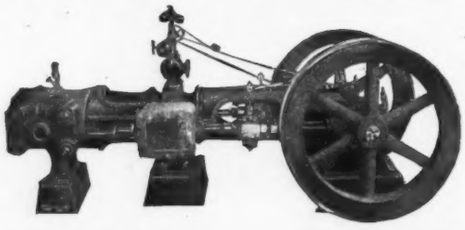
District Offices: New York, Chicago, Birmingham, El Paso, San Francisco

Western Sales Offices: United Iron Works, Spokane, Wash.; Moran Engineering Company, Seattle, Wash.

PRINCIPAL PRODUCTS: Rock Crushing Machinery—Mining and Smelting Machinery—Cement-Making Machinery—Wood Impregnating Plants—Power Transmitting Machinery—Loomis-Pettibone Gas Generators—Suction Gas Producers—Cyanide and General Steel Tank Work.

M143.2

Air Compressors



The Laidlaw-Dunn-Gordon line of Air Compressors is most comprehensive and includes apparatus especially designed for every service. Prospective users are invited to correspond with us in regard to their requirements.

*Write for Bulletin L*518-16

THE LAIDLAW-DUNN-GORDON CO.

WORKS: CINCINNATI, OHIO New York Office: 115 Broadway

Offices in all principal cities

L142.2

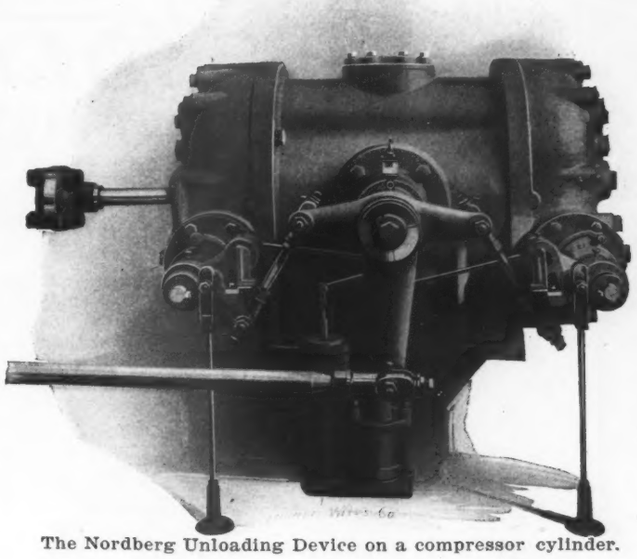
The Nordberg Unloading Device For Small Constant Speed Compressors

The Nordberg Unloading Method is the practical way of regulating output of constant speed compressors of smaller sizes because it gives close regulation—it does not waste power as is the case where the inlet is throttled.

The unloading in Nordberg compressors is positive and complete and does not depend upon the action of delicate mechanisms.

There is nothing complicated about it—its operation is easily understood.

The unloading is performed in steps—for instance, in a twin compressor with two double acting cylinders the unloading of the machine takes place as follows—first the head end of one cylinder is unloaded, then the crank end of the other, next the crank end of the first cylinder and finally the head end of the second cylinder. Where the full power is 120 h.p. the machine is relieved of 30 h.p. at each step.



The Nordberg Unloading Device on a compressor cylinder.

NORDBERG MACHINERY

No other form of unloading device will accomplish this.

Write for Catalog fully describing Nordberg High Efficiency Engine for Mines and Smelters.

Nordberg Manufacturing Company, Milwaukee, Wisconsin

Builders of Corliss Engines, Poppet Valve Engines, Air Compressors, Blowing Engines, Hoisting Engines, Pumping Engines, Steam Stamps.

NEW YORK: 42 Broadway | CHICAGO: 704 Schiller Bldg. | GLOBE: Arizona | BUTTE: Electric Bldg.

Diamond Drills

We make the most complete line in the world. Hand Power, Horse Power, Gasolene, Steam, Air, Electricity, Hydraulic Feed, Screw Feed.

Send for Catalogue.

STANDARD DIAMOND DRILL CO.,
745 First National Bank Bldg. Chicago, U. S. A.

JUST ISSUED

Bulletins illustrating Class "G" and Railroad Types

CHICAGO PNEUMATIC AIR COMPRESSORS

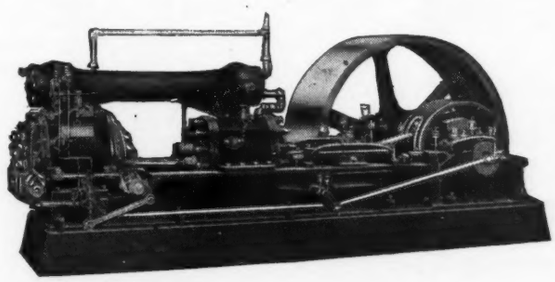
Also ROCK DRILL and MINING CATALOG which we will be pleased to mail on request

CHICAGO PNEUMATIC TOOL CO.

CHICAGO And all prominent cities NEW YORK

Automatic Selective Proportional Unloaders

are found exclusively on the



Norwalk Compressor

These improvements mark a new era in compressor construction. They gain the instant and favorable attention of all skilled engineers. ¶ For the usual hackneyed claims of *economy, durability* and *efficiency*, let our forty years' experience be an assurance of adequate and discerning attention to every feature.

The Norwalk Iron Works Co.
South Norwalk, Conn.

STILL IN THE FOREFRONT

Improved Wood Rock Drills

It always *was* in the forefront, but with recent improvements it is so far ahead of every single other rock drill that others deserve simply to be sent to the scrap-heap in comparison. The cylinder, chest and air-head are now made of Vanadium Tungsten Iron, which is 100% stronger than the ordinary iron used in Rock Drills, which in one case was shown to have a tensile strength of 45,000 lbs. where cast iron had but 18,000 and which actually *hardens* under friction instead of crystallizing. It is so hard it can hardly be cut with a file; it is impossible to break, and its wearing qualities far surpass that of any other metal or alloy. That simply means the Wood Drill now has *twice the life* of other drills, and while it lives, it does *better work*. If you want your work done *best*, done most *economically*, you will order one of these drills, *without delay*. ONE ONLY, ranged alongside other drills, will show immediately in difference of work.

The Rock Drill that can be "cleaned up with a sledge hammer," and "wiped off with a scoop shovel," and yet "stay with you"

Wood Drill Works
30 Dale Avenue, PATERSON, N. J.

LOOK CAREFULLY AT THIS SEAL

SWEDISH IRON & STEEL CORPORATION — SISCO — NEW YORK-NEW ORLEANS

IT STANDS FOR

"Sisco Acorn" Steel

THE BEST FOR ROCK DRILLS

REMEMBER THAT

We back this statement with our ironclad guarantee, which protects you.

You take no risks, we see to that.

Write for information and test quantities.

Swedish Iron & Steel Corporation
12 Platt Street, New York, N. Y.
428 Race Street, New Orleans, La.

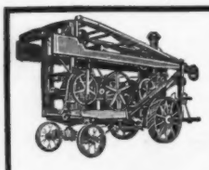
Interlocking Construction

AMERICAN METAL HOSE FOR STEAM

Outlasts Rubber Hose Many Times

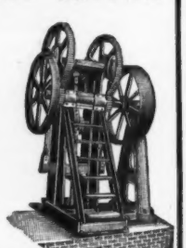
Try a length at special trial order price and be convinced. Price folder G on application.

THE AMERICAN METAL HOSE CO.
Waterbury, Connecticut



Keystone Cable Drills

are used for Copper and Zinc Prospecting, Placer Gold Testing, Heavy Blast Hole Drilling, Artesian Water, Oil and Gas Wells. Many sizes, all depths to 2500 ft. Traction and Non-Traction. Steam and Gasolene Engine Driven. Catalogs No. 1, No. 2, No. 2-B, No. 3, No. 4, No. 7.

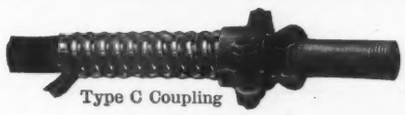


Downie Double Stroke Deep Well Pumps

steam or power driven, are designed for heavy service in deep Artesian Wells. Single stroke pumps for lighter deep well work. Catalog No. 6.

Keystone Test Drill Company,
Beaver Falls, Pa.
170 B'way, New York **Monad. Blk., Chicago**

WHY
SPRAGUE
FLEXIBLE STEEL ARMORED
HOSE LEADS ALL OTHERS



Type C Coupling

NO CHAFING NO KINKING NO BURSTING

The interlocking armor not only affords protection against external injury but reduces deterioration of the rubber hose due to internal pressure. Rubber when stretched deteriorates very rapidly. This is eliminated in the "Sprague" Hose as the armor offers very high resistance against internal pressure. For the same reason, the hose cannot burst and as the fittings cannot blow out, expensive delays are eliminated. The Flexibility is as good as the unarmored hose. "Sprague" Hose will "pay for itself" under the most severe conditions.

Ask for Pamphlet No. 51632

SPRAGUE ELECTRIC WORKS

OF GENERAL ELECTRIC COMPANY

Main Offices: 527-531 West 34th Street, New York, N. Y. **Branch Offices in Principal Cities.**

Murphy Rock Drills

Stopers Sinkers Drifters **Valveless Air Hammer Drills**

Stopers use solid steel. Sinkers and Drifters hollow steel and clean the holes with a blast of compressed air. Down holes, wet or dry, can be cleaned perfectly to a depth of 8 feet.

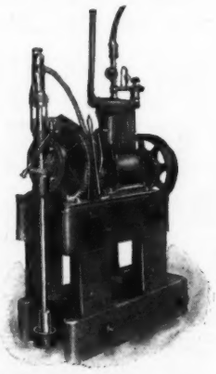
We do not claim that our machines will drill *faster* than any others. Many rock drills will drill very fast, but it is difficult to make a machine that will stand up day after day and month after month without coming on top for repairs; and this is what we claim for our machines. Repairs on them, year in and year out, will not amount to more than $24.00 per year. We make guarantee on cost of up-keep and economy in air.

With any of them, one man can drill 90 ft. in hard rock and blast in one eight-hour shift.

Although we make special machines for Stoping, Drifting and Sinking, we also make a machine that can be used for Stoping with Solid Steel or Drifting and Sinking with Hollow Steel.

Send for latest bulletins.

C. T. Carnahan Mfg. Co., Denver, Colo., U. S. A.



TERRY CORE DRILLS

Our Core Drills are being used for practically all the prospecting work now being done in the Porcupine gold fields. One customer has four. There is a reason.

Catalogue on application.

McKIERNAN-TERRY DRILL CO.

115 Broadway :: :: New York

Rock Drills, Hammer Drills, Sheet Pile Hammers, Air Compressors

Bulldog Brand

Registered Trade Mark

When you want to know what Drill Steel to buy ask the record-breaking Drill Men what Brand they use. They will tell you

"BULLDOG"

the Choicest of all Swedish Charcoal Drill Steels.

Made Solid and Hollow, and imported only by

International High Speed Steel Co.

FRANKLIN SQUARE, NEW YORK CITY

We Can Make Immediate Shipments Of

Diamonds and Carbon

(South African and Brazilian) **(Black Diamonds)**

For Core Drills And All Industrial Purposes

Every Quality and Size

Largest stock in America. Telegraph or write your requirements. Selection package sent to responsible firms.

Stern Bros. & Co. Industrial Diamond Department **136-142 West 52d St., New York**

Whitcomb Stop Cocks

For Compressed Air Lines And Cyanide Plants

are all tested with 80 lbs. pressure, or more, *under water* before they leave our plant. We *guarantee* them to be tight. The body is made of malleable iron, the plug of a good bronze metal. The only part of the bronze plug that comes in contact with the iron plug in the bottom of the valve is the small projection. Consequently there is least amount of friction and the wear on the bronze plug can be easily taking up by screwing up the iron plug.

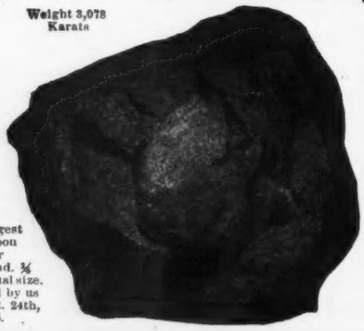
Send for circulars and prices

George D. Whitcomb Co., Rochelle, Illinois

New York 108 Fulton St. | Paris 10 Rue Monthoion | London Audrey House, Ely Pl.

J. Baszanger & Co.

Weight 3,078 Karats



Largest carbon ever found. ¾ actual size. Sold by us Sept. 24th, 1895.

Largest Importers of

Carbons

(Black Diamonds)

For

Diamond Drills

Scranton, Pa., 314 Peoples Nat. Bk. Bldg.
Duluth, Minn., 710 Torry Bldg.
Denver, Col., 225 E. Maple St.

When wanting goods please communicate with our nearest office.

CROCKER-WHEELER

INDUCTION MOTORS

Combine
Great Mechanical Strength
and
Long Life with Efficiency
and
High Power Factor.

Bulletin PE tells how.

CROCKER-WHEELER CO., AMPERE, N. J. Branches, Principal Cities.

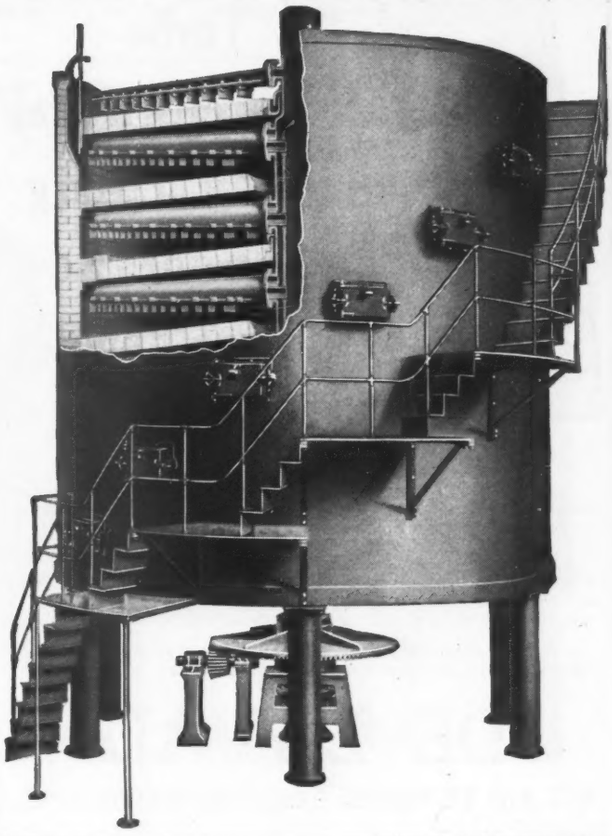
Low Repair Costs
is one of the Big Features of

The New Herreshoff Furnace

All metal parts exposed to heat are air-cooled. Thus long life is assured them. Roasting is under perfect control. Easily operated—one man can attend to many.

Let us send you full details

The General Chemical Co.
Herreshoff Furnace Dept.
25 Broad Street - - New York



Every Superintendent

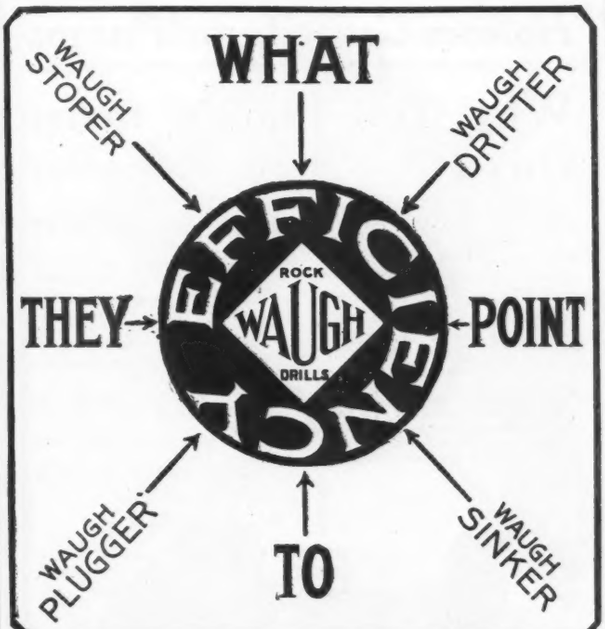
To whom we have been able to make a demonstration of the "Cleveland" Stope Drill has been convinced that it is the stoper of best results.

Will you let us demonstrate this to you? We will be glad to do it without any risk of dissatisfaction on your part—

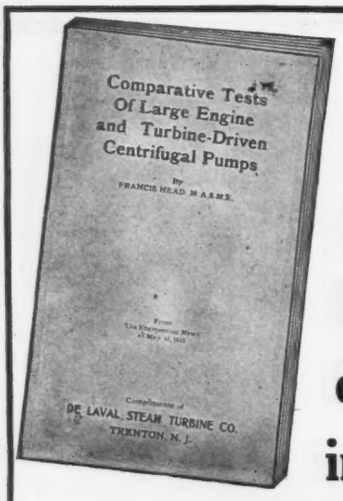
By sending you a "Cleveland" to try for 30 days in your mine.

It will pay you to investigate. *Write for Bulletin* 30.

The
Cleveland Rock Drill Co.
Hawthorne Ave.
Cleveland, Ohio.
New York Office, Room 520, 30 Church Street



THE Denver Rock Drill & Machinery Co.
OFFICES AND WAREROOMS
Denver, New York, El Paso, Salt Lake City, San Francisco, Johannesburg, So. Africa, Melbourne, Australia
WORKS
DENVER, COLORADO, U. S. A.



Turbo-Centrifugal Pumping Engines Reduce Pumping Expense

With ordinary prices of coal, a steam turbine-driven centrifugal pump will deliver water at one-half or even one-third the cost entailed by high-duty vertical triple-expansion pumping engines.

By utilizing the De Laval Multi-stage Steam Turbine, we are now prepared to supply turbo-centrifugal pumps in all sizes and capacities and for all heads, and to guarantee duties which enable them to compete successfully with pumping engines of the highest duty.

Send for Pamphlet No. 49, describing comparative tests of large turbine-driven and engine-driven centrifugal pumps.

DE LAVAL

STEAM TURBINE CO., TRENTON, N. J.

55

MINE PUMP

For Shaft and Emergency Work

CARRIED IN STOCK

¶ **A short, strong, compact pump, with *immediate* access to *all* water valves by removal of *one* side plate. Send for Bulletin P101-16.**

Fred.M.Prescott Steam Pump Co.

MILWAUKEE, WISCONSIN

District Sales Offices:—El Paso, Texas—Salt Lake City, Utah. P 115.2.

Holmes Centrifugal Pumps

Why You Should *Insist* On The Open Impeller

No. 5 Eliminating Quantity Leakage

The inclosed impeller of the usual centrifugal pump is a *glaringly* bad feature.

This is because of the rapid wear it causes at the revolving joint where the impeller enters the suction opening.

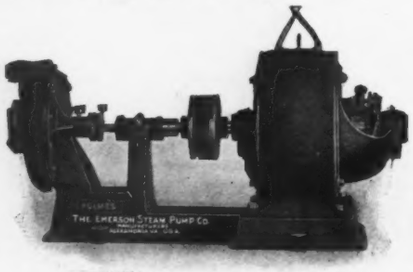
Sometimes the wear at this point is so rapid that it cuts out in a few hours' run to such an extent that the leakage from the discharge back to the suction chamber is 25 to 50 per cent. of the total quantity of liquid pumped.

This is why we have made a radical change in the construction of Holmes Centrifugal Pumps.

An open impeller takes the place of the inclosed type.

And the result is lasting efficiency instead of *dwindling* efficiency.

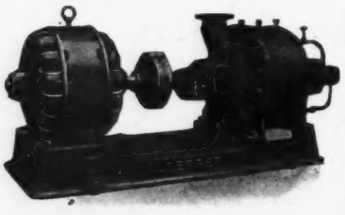
We'll be glad to go into details with you.



The Emerson Steam Pump Co.

Alexandria, Va.

For Severe Service Alberger Centrifugal Pumps



Which is simply another way of saying that the Alberger is just the pump for mine service. For there is no pumping service that is more severe than mining with its gritty, acidulous water and high lifts.

Get full details. A post card brings them.

Alberger Pump Company

140 Cedar St.

Chicago, Ill. New York St. Louis, Mo.

50 HP. COMBINATION INCLINE AND VERTICAL SINKING PUMP

Capacity 400 gal. per min. under 285 ft. head at 1700 R.P.M.

Write for particulars.

BYRON JACKSON IRON WORKS, Inc.

357-361 Market St., San Francisco, Cal.

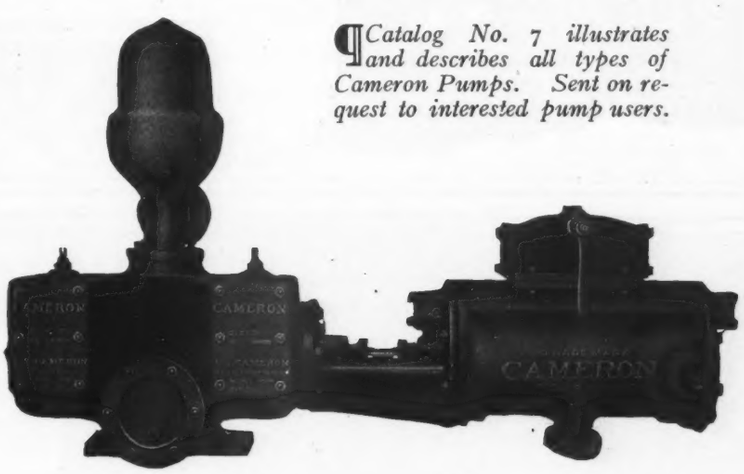
Los Angeles—212 No. Los Angeles St. Works—West Berkeley, Cal.

THE SLOGAN OF THE CAMERON—"CHARACTER: THE GRANDEST THING."

CAMERON PUMPS

CAMERON LONG STROKE PATTERN PUMP FOR STATION DUTY is shown in the illustration. This type is especially adapted to service where there is a long suction line with high lift and with intermittent or continuous pumping.

Where the service is severe, the conditions exacting and continuous operation is desired, always choose a Cameron Pump. There's a type of proved ability for every service.

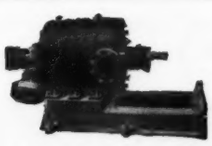


¶*Catalog No. 7 illustrates and describes all types of Cameron Pumps. Sent on request to interested pump users.*

A. S. Cameron Steam Pump Works

Foot of East Twenty-Third Street, New York

12-30-11



20 To 50% Actual Higher Efficiency

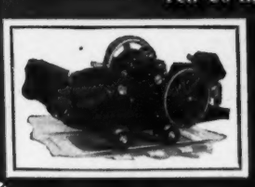
We will prove, by actual tests made before shipment, that the Hayton Turbo-Centrifugal Pump is capable of doing all we claim.
Wouldn't you be interested in a pump which is able to save enough on cost of operation to hand you back its initial cost the first six months?
The Hayton Turbo-Centrifugal Pump does this—*and we can prove it.* We will send you a test chart, before shipment, and guarantee Hayton Pumps to live up to the figures. How about a catalog?

Hayton Pump Company
Quincy, Illinios

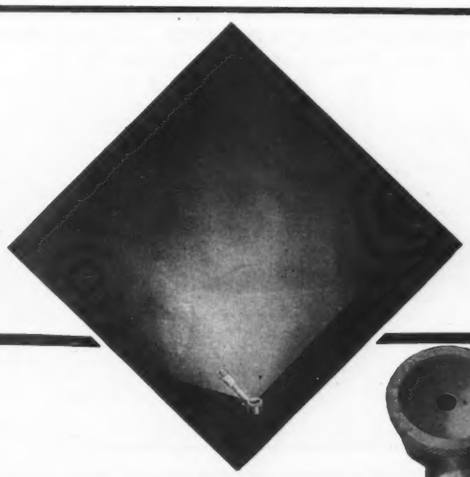
Deming Mine Pumps
STATIONARY AND PORTABLE

Electric Driven—No Loss From Steam Condensation

Tell Us the Conditions



The Deming Company
SALEM :: OHIO
Hand and Power Pumps for All Uses
HENION & HUBBELL :: Chicago
HARRIS PUMP & SUPPLY CO. Pittsburg
RALPH B. CARTER CO., New York
Other Agencies in All Principal Cities



For Moistening Air,
Settling Dust, Soot, Ashes,
Cooling Condensing Water,

and numerous other purposes where the greatest atomizing effect is essential to best results, there is nothing just as good as the

"Buffalo" Spray Nozzles

They operate with the lowest water pressure (15 lbs. and up), have the largest nozzle opening to prevent clogging, yet give the greatest atomizing effect. Made in brass or special metals for special uses and for any capacity.

Write our nearest house for our new Booklet 114*G.*

BUFFALO FORGE CO., BUFFALO, N. Y.

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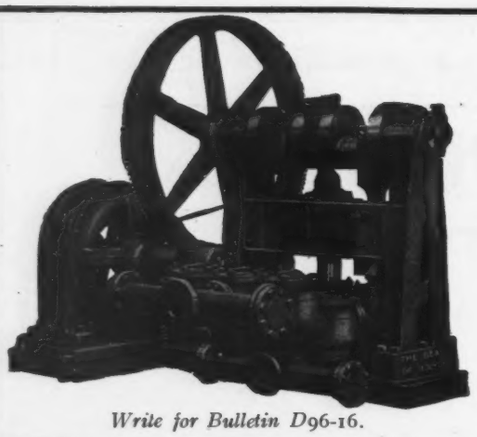

FOR DEPENDABLE SERVICE INSTALL

DEANE OF HOLYOKE MINE PUMPS

Heavy Construction. Large Bearings.
All Parts Accessible. Liberal Valve Areas.

THE DEANE STEAM PUMP CO.
WORKS: HOLYOKE, MASS. New York Office: 115 Broadway

Write for Bulletin D96-16.

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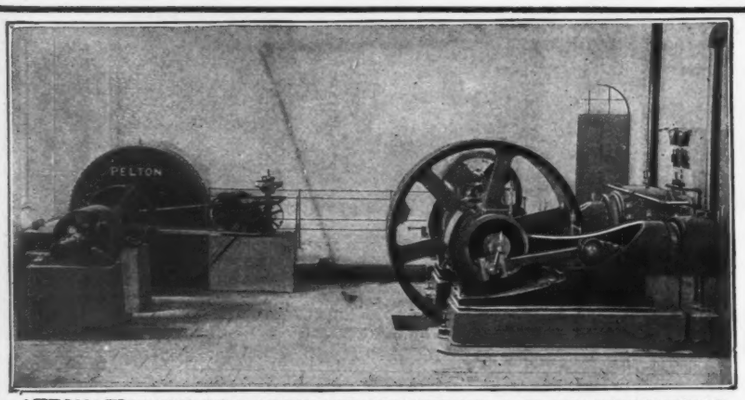
D164.2



AUTOMATICALLY GOVERNED PELTON WHEEL AND AIR COMPRESSOR

DON'T!

purchase a water wheel for driving an air compressor until thoroly investigating the merits of Pelton Wheels equipped with "automatic air control" for speed regulation.

Complete information sent to users of Air Compressors.

THE PELTON WATER WHEEL CO.

2223 Harrison St. SAN FRANCISCO, CAL.
87 West St. NEW YORK CITY

Epping-Carpenter Company
Main Office and Works: Pittsburg, Pa.

Manufacturers of Duplex and Single Steam Pumps for all purposes, also Surface and Jet Condensers.

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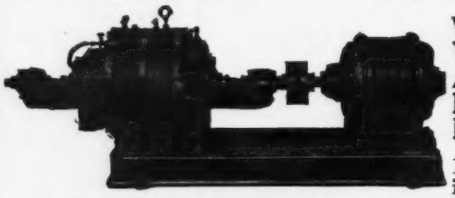
Krogh Pump Mfg. Company
149-157 Beale Street **San Francisco, Cal.**



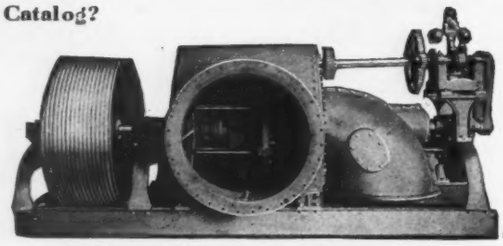
Why Do You Want A Krogh Pump? Because:—

It has Ring Oiling Air Sealed Gland and Ring Oiling Bearings. Is Automatically Water balanced against all end thurst and runs without set collars or thrust bearings. Is the best pump on the market. That is Why! *Write for our Bulletin No. 83.*

The Mine & Smelter Supply Company represent us in the following territory: Salt Lake City, Utah; Denver, Colorado; El Paso, Texas; City of Mexico; City of New York.

Samson Turbines

Catalog?

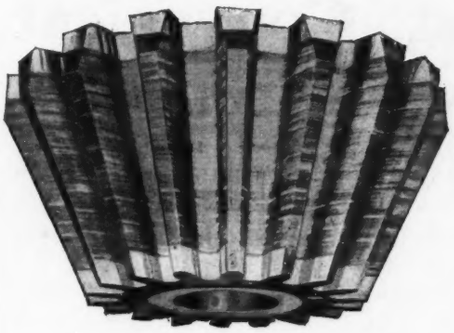


High speed, low cost, great power

James Leffel & Co.,
306 Lagonda St., Springfield, Ohio, U. S. A.

R. D. WOOD & CO., 400 CHESTNUT ST., PHILADELPHIA, PA.
CENTRIFUGAL PUMPS
For Mines and Sinking Purposes
GRAVEL AND WATER PUMP
For Placer Mining a Specialty
CIRCULATING PUMP
Cast Iron Pipe, Tanks, Gas Producers and Iron Casting

Frenier's Spiral Pump
The most durable pump for elevating
TAILINGS, SLIMES, BATTERY SANDS, ETC.
NO VALVES NO BUCKETS
FRENIER & SON, Rutland, Vt.
AGENTS—Allis-Chalmers Co., Chicago, Ill. Stearns-Roger Mfg. Co., Denver, Col. Harron, Rickard & McCone, San Francisco, California.



"Matchless" Raw Hide Pinions

on your gear drives will eliminate noise and increase production

ASK US—WHY?

when you write for our Catalog, which gives Tables and Rules for figuring Bevel and Spur Gears, a complete list of Stock Gears and general information on

Gear Wheels and Gear Cutting

WRITE NOW!!!

PHILADELPHIA GEAR WORKS

Geo. B. Grant, M. E.

1120 VINE STREET PHILADELPHIA, PA.

DANVILLE

The Longer You Use The Danville The Better You Like It

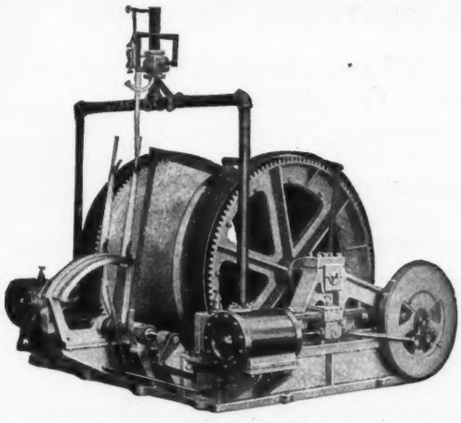
Any operator or owner of a Danville Hoist will gladly show you its fine points and its economic advantages. Write for his address.

Danville Foundry & Machine Company, Danville, Ill., U. S. A.

Pittsburg Representative, F. K. Potter, Keenan Bldg., Pittsburg. The Hendrie & Bolthoff Mfg. & Supply Co., Sole Agents for Colorado, Wyoming, New Mexico and South Dakota.

HOISTING ENGINES

LIDGERWOOD MINE HOISTS



Double Gear, Reversible Mine Hoist with Post Brakes

Built With Low Side Stands

30 to 200 Horse Power

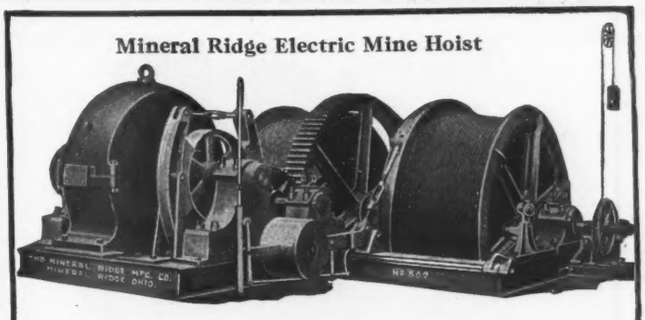
Cableways for all Hoisting and Conveying Purposes

Lidgerwood Mfg. Co.

96 Liberty Street New York

Chicago Pittsburgh Seattle London, England

Mineral Ridge Electric Mine Hoist



Efficient And Reliable Under Any Conditions

Mineral Ridge Mine Hoist

Because of their *reliable* efficiency and their lasting efficiency, Mineral Ridge Hoists are suited to give most satisfactory service under any mine conditions.

They are so arranged that they can be operated from a distance, or can be made entirely automatic in action. Easily controlled, have a very low operating cost, and are perfectly safe at all times.

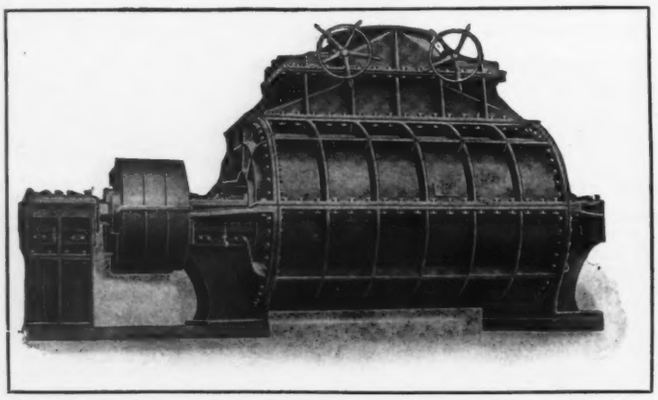
You will find that Mineral Ridge Hoists, either steam or electric, will answer your hoisting requirements in the most satisfactory manner.

Write for the full particulars.

THE MINERAL RIDGE MFG. COMPANY

MINERAL RIDGE, OHIO

The Root Is The Most Convenient Of All Pressure Blowers For Smelting



The reason is found in the superior design and method of adjustment in the double ring-oiling, adjustable babbitted sleeve quarter box bearing.

This is provided with a removable babbitted sleeve. When it is necessary to examine or rebabbitt the bearings, the sleeve can be taken out, without disturbing the balance of the box, rebabbitted and returned to its place.

This is but one of many advantages found in the "Root." They're all worth looking into.

If you will write us, we will gladly go into fullest details. A post card brings our Catalog.

P. H. and F. M. Roots Company, Connersville, Ind.

NEW YORK,
120 Liberty Street.

CHICAGO,
1245 Marquette Building.

Vulcan Hoists

are widely known for their efficiency and economy.

VULCAN PRODUCTS

include Hoisting and Haulage Engines, Mining Machinery, Tubular Boilers, Mine Ventilating Fans, Elevating and Conveying Machinery.

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Flory Engines

For Contractors, Pile Driving, Quarry And Mine Duty.

Also tail rope haulage, inclines, slate machinery and suspension cableways.
Ask for Catalog.
Satisfaction guaranteed

S. Flory Mfg. Co., Bangor, Pa.

Whether cut-tooth or cast-tooth gears are the more economical and practicable is a matter of **conditions. We make both** 1-inch to 6-inch pitch and larger, of cast-iron, steel, or high grade semi-steel.
Our neutral position and wide experience enables us to determine fairly what kind of gears to use for a given set of conditions, and we shall be glad to confer with you.

SEND US YOUR LISTS FOR PRICES

H. W. CALDWELL & SON CO.

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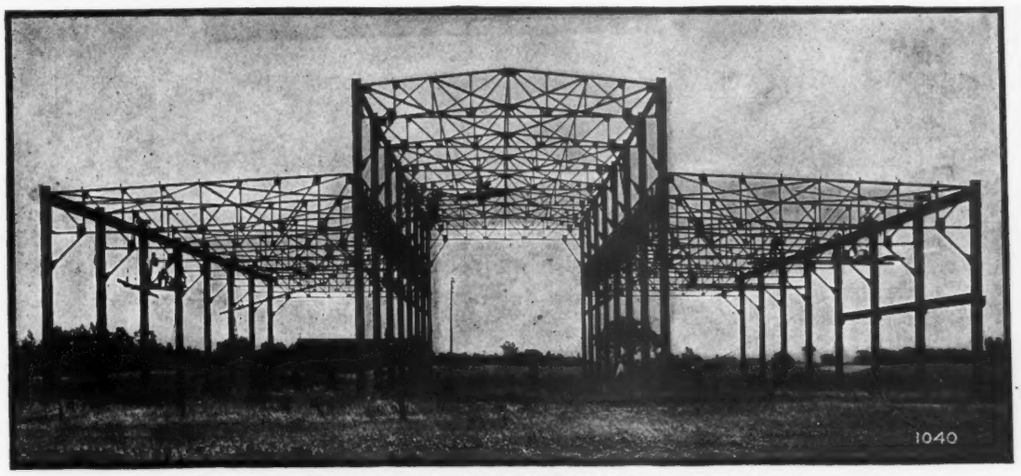
NEW YORK—Fulton Building, Hudson Terminal, 50 Church Street.

American Bridge Company of New York

STRUCTURAL STEEL FOR EVERY PURPOSE

OFFICES IN 17 AMERICAN CITIES



CAR SHOP—WESTERN PACIFIC RAILWAY COMPANY, SACRAMENTO, CAL.

General Office: Hudson Terminal, 30 Church Street, New York

Export Representatives: United States Steel Products Company, 30 Church Street, New York

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The New Century Differential Motion Jig

Makes a perfect separation of all free ore in mixture and settles it to ore bed. Automatically removes clean ore from sieve as fast as it settles.

Makes the cleanest tailings product—minimum amount of power and water used in operation. Stratifies all the middlings—automatically removes *only* those middlings that are to be again crushed.

Write for Bulletin 11.

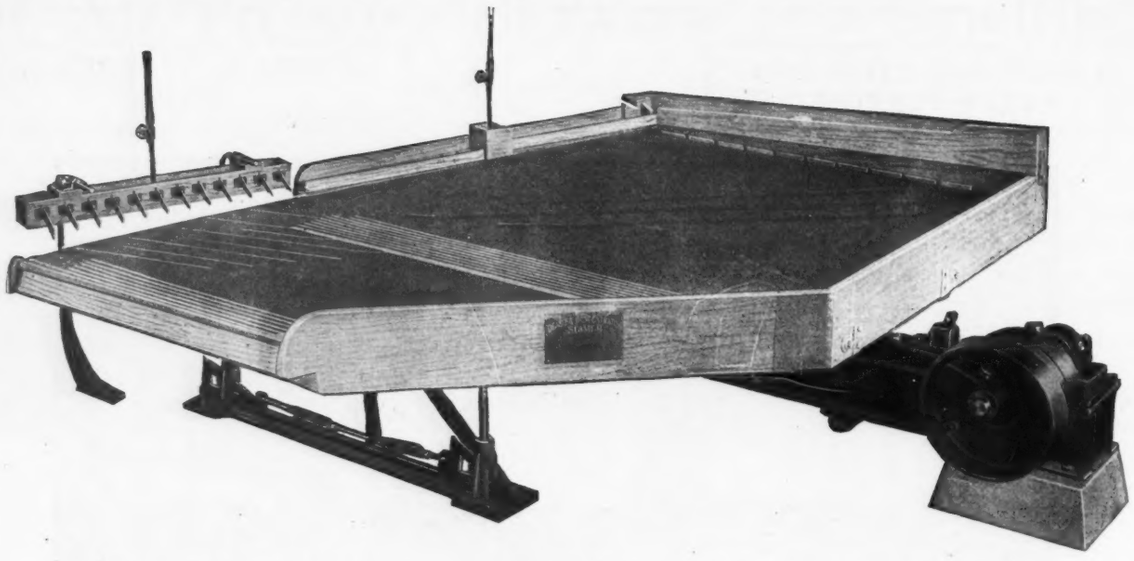
American Concentrator Company,
Joplin, Mo., U. S. A.

HEAVY PLATE WORK

RITER-CONLEY MFG. CO.
PITTSBURGH

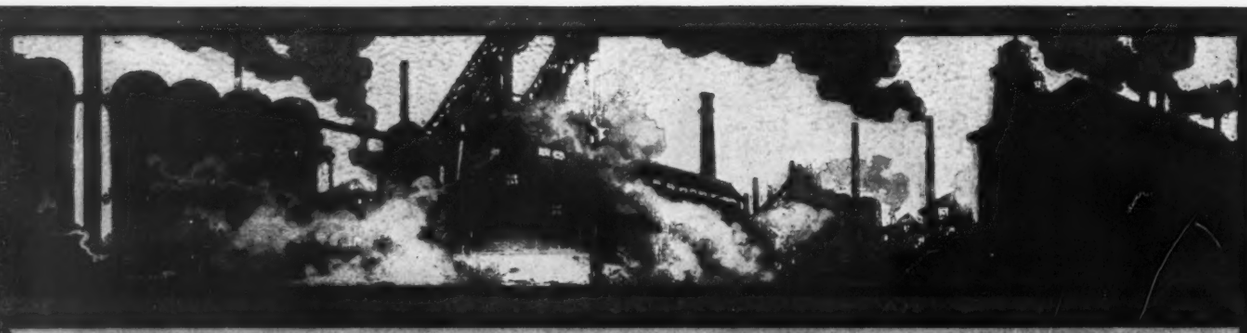
Plate and Structural Work of Every Description
Complete Plants

Improved No. 3 Deister Slime Table



The complete table equipment for the Hollinger Gold Mines, Ltd., of Porcupine, Canada, consisting of 40 Improved No. 3 Deister Slime Tables has been placed with

The Deister Concentrator Co., Fort Wayne, Ind., U.S.A.



WHY is a BLAST FURNACE or STOVE BRICK always compared with Harbison-Walker FIRE BRICK?

BECAUSE forty years of growth, of experience, of honest, earnest effort has made it what we've always aimed to keep it—the STANDARD.

Insure results—write us.

Harbison-Walker Refractories Co.

PITTSBURGH :: :: PENNSYLVANIA

SALES OFFICES IN
Pittsburgh, Chicago, Philadelphia, New York, Birmingham

PLANTS IN
Pennsylvania, Indiana, Alabama, Ohio, Kentucky

Mining Companies—United States.

Name of Company and Situation.		Shares. Issued.	Par Val.	Dividends. Total to Date	Latest. Date.	Amt.
Acacia, g.	Colo	1,438,988	$ 1	$ 129,618	Jan. '11	$0.01
Adams, s.l.c	Colo	80,000	10	778,000	Dec. '09	0.04
Alaska Mexican, g.	Alas	180,000	5	2,824,381	May '11	0.20
Alaska Treadwell, g.	Alas	200,000	25	12,035,000	Aug. '11	0.50
Alaska United, g.	Alas	180,200	5	684,683	Feb. '11	0.15
Am. Zinc, Lead & Sm.	U. S.	80,120	25	560,420	Oct. '11	0.50
Anaconda, c.	Mont	6,000,000	25	66,900,000	Oct. '11	0.50
Argonaut, g.	Cal.	200,000	5	1,200,000	June '10	0.05
Arizona Copper, pf.	Ariz	1,426,120	1.20	1,943,780	Nov. '11	0.047
Arizona Copper.com.	Ariz	1,519,896	1.20	13,768,469	July '11	0.30
Bagdad-Chase, g., pf.	Cal	84,819	5	202,394	Jan. '09	0.10
Baltic, c.	Mich.	100,000	25	7,550,000	June '11	5.00
Bingham N. H., c.	Utah	228,690	5	202,743	Nov. '11	0.10
Boston & Montana, c.	Mont	150,000	25	71,825,000	Feb. '11	4.00
Bunker Hill Con., g.	Cal.	200,000	1	511,000	Oct. '11	0.07½
Bunker Hill & Sul., ls.	Ida	327,000	10	13,094,250	Nov. '11	0.20
Butte & Ballaklava, c.	Mont	250,000	10	125,000	Aug. '10	0.50
Caledonia, l.s.c.	Ida	1,300,000	1	52,000	June '10	0.01
Calumet & Arizona, c.	Ariz	650,000	10	13,850,000	Dec. '11	1.00
Calumet & Hecla, c.	Mich.	100,000	25	115,250,000	Sept. '11	6.00
Camp Bird, g. s.	Colo	1,100,000	5	7,047,000	May '11	0.24
Centen'l-Eur., l.s.g.c.	Utah	100,000	5	3,300,000	Oct. '11	3.00
Center Creek, l.z.	Mo	100,000	10	415,000	Apr. '11	0.05
Champion, c.	Mich.	100,000	25	6,000,000	May '11	1.00
Cliff, g.	Alas	100,000	1	140,000	May '11	0.25
Colo. Gold Dredging	Colo	100,000	10	125,000	Sept. '11	0.25
Colorado, l.s.g.	Utah	1,000,000	0.20	2,450,000	Dec. '11	0.03
Columbus Con., g.s.	Utah	285,540	5	226,832	Oct. '07	0.20
Commercial Gold.	Ore.	1,750,000	1	43,750	Dec. '10	0.00½
Con. Mercur., g.	Utah	1,000,000	1	3,385,313	Dec. '06	0.02½
Continental, z. l.	Mo	22,000	25	242,000	Jan. '11	0.50
Copper RangeCon., c.	Mich.	384,185	100	12,094,216	Oct. '11	0.75
Daly-Judge, s.l.	Utah	300,000	1	225,000	Apr. '07	0.37½
Daly West, s.l.	Utah	180,000	20	6,417,000	Oct. '11	0.30
Doe Run, l.	Mo.	65,782	100	2,941,849	Dec. '11	1.50
Elkton Con., g.	Colo	2,500,000	1	2,929,460	Dec. '11	0.01½
El Paso, g.	Colo	2,450,000	1	1,413,545	June '11	0.01
Fed. M. & S., com	Idaho	60,000	100	2,708,750	Jan. '09	1.50
Fed. M. & S., pf.	Idaho	120,000	100	6,851,250	Dec. '11	1.75
Florence, g.	Nev	1,050,000	1	840,000	Apr. '11	0.10
Frances-Mohawk, g.	Nev	912,000	1	546,000	Jan. '08	0.05
Free Coinage, g.	Colo	10,000	100	180,000	Dec. '09	1.00
Frontier, z.	Wis.	1,239	100	96,642	June '11	3.00
Gold Coin of Victor	Colo	1,000,000	1	1,350,000	Feb. '09	0.02
Gold King Con., g.	Colo	5,750,370	1	1,234,808	Dec. '09	0.01
Golden Star, g.	Ariz	400,000	5	140,000	Mar. '10	0.05
Goldfield Con., g.	Nev	3,558,367	10	18,144,772	Oct. '11	0.50
Grand Central, g.	Utah	250,000	1	1,557,500	July '10	0.06
Granite g.	Colo	1,650,000	1	253,000	Dec. '10	0.01
Hazel, g.	Cal	900,000	1	711,000	Dec. '10	0.00½
Hecla, l. s.	Idaho	1,000,000	0.25	2,350,000	Dec. '11	0.02
Hercules, l.s.	Idaho	1,000,000	1	3,500,000	Nov. '08	0.06
Homestake, g.	S. D	218,400	100	27,539,040	Dec. '11	0.50
Iowa, g.s.l.	Colo	1,666,667	1	200,166	June '11	0.00½
Iron Blossom, s.l.g.	Utah	1,000,000	0.10	1,000,000	Dec. '11	0.03
Iron Silver, s. l.g.	Colo	500,000	20	4,450,000	July '11	0.10
Jamison, g.	Cal	390,000	10	378,300	Jan. '11	0.02
Jerry Johnson, g.	Colo	2,500,000	0.10	125,000	Nov. '10	0.01
Kendall, g.	Mont	500,000	5	1,355,000	June '11	0.02
Kennedy, g.	Cal	100,000	100	1,831,001	Apr. '10	0.03
King of Arizona, g.	Ariz	200,000	1	396,000	Aug. '09	0.12
Liberty Bell, g.	Colo	130,551	5	522,093	Oct. '10	1.00
Little Bell, l.s.	Utah	300,000	1	75,000	Mar. '11	0.05
Little Florence, g.	Nev.	1,000,000	1	430,000	Jan. '08	0.03
Mammoth, g.s.c.	Utah	400,000	25	2,220,000	Mar. '08	0.05
Mary McKinney, g.	Colo	1,309,252	1	907,456	June '11	0.01
May Day, g. s. l.	Utah	800,000	0.25	108,000	Sept. '08	0.01½
Mohawk M. Co.	Mich.	100,000	25	2,225,000	Aug. '11	1.75
Monarch-Mad'a, g.s.l.	Colo	1,000,000	1	30,000	Feb. '11	0.01
Montana-Tonop., s.g.	Nev	921,865	1	330,000	Dec. '11	0.06
Mountain, c.	Cal	250,000	25	4,216,250	May '08	0.44
National, g.	Nev	750,000	1	570,000	May '11	0.10
Nevada Con., c.	Nev.	1,151,200	5	3,885,300	Dec. '11	0.37½
New Century, z.l.	Mo.	330,000	1	237,600	Oct. '09	0.01
New Idria, q.	Cal	100,000	5	1,450,000	Oct. '11	0.30
North Butte, c.	Mont	410,000	15	9.756,000	Oct. '11	0.30
North Star, g.	Cal	250,000	10	3,486,989	Dec. '11	0.80
OldDomin'n, M&Sm.	Ariz	162,000	25	1,822,500	Oct. '11	1.00
Ophir, s. g.	Nev.	201,600	3	2,048,200	Nov. '11	0.10
Oroville Dredging	Cal	700,000	5	1,383,036	Dec. '09	0.12½
Osceola, c	Mich.	96,150	25	9,679.775	July '11	3.50
Parrot, c.	Mont	229,850	10	7,014,511	Nov. '11	0.15
Pearl Con., g.	Wash	1,909,711	0.05	181,422	Dec. '10	0.02
Pharmacist, g.	Colo	1,500,000	1	87,500	Feb. '10	0.00½
Pioneer, g.	Alas	5,000,000	1	1,891,526	Aug. '10	0.03
Portland, g.	Colo	3,000,000	1	8,917,080	Oct. '11	0.02
Quincy, c.	Mich.	110,000	25	19,880,000	Dec. '11	1.00
Republic, g.	Wash	1,000,000	1	85,000	Dec. '10	0.01½
Rochester, l.z.	Mo	4,900	100	188,396	Dec. '10	0.50
Round Mountain, g.	Nev.	866,426	1	328,404	Sept. '10	0.04
St. Joseph, l.	Mo	1,000,000	10	7,808,357	Sept. '11	0.15
Shannon, c	Ariz	300,000	10	450,000	July '07	0.50
Shattuck-Arizona, c.	Ariz	350,000	10	1,050,000	Jan. '11	1.00
Silver King Coal, l.s.	Utah	1,250,000	5	‡1,659,885	Jan. '10	0.15
Sioux Con., s. l. g.	Utah	745,389	1	872,097	July '11	0.04
Skidoo, g.	Cal	1,000,000	5	100,000	July '10	0.05
Smuggler, l.s.z.	Colo	1,000,000	1	2,235,000	Nov. '06	0.03
Snowstorm, c.g	Ida	1,500,000	1	1,005,000	Aug. '10	0.01
Standard Con., g.s.	Cal	178,394	10	5,211,970	Dec. '10	0.10
Stratton's Ind., g.	Colo	1,000,000	0.60	242,500	Nov. '11	0.06
Tamarack, c.	Mich.	60,000	25	9,420,000	July '07	4.00
Tennessee, c.	Tenn	200,000	25	2,606,250	Jan. '11	1.50
Tomboy, g. s.	Colo	300,000	4.85	2,792,400	June '11	0.48
Tonopah Belm't, s.g.	Nev.	1,500,000	1	2,093,003	Oct. '11	0.25
Tonopah of Nev., s.g.	Nev.	1,000,000	1	8,050,000	Oct. '11	0.40
Tri-Mountain, c.	Mich.	100,000	25	950,000	Dec. '10	1.00
Uncle Sam, g. s. l.	Utah	500,000	1	495,000	Sept. '11	0.05
United (Crip. Ck.) g.	Colo	4,000,100	1	440,435	Jan. '10	0.04
United Verde, c.	Ariz	300,000	10	28,522,000	July '11	0.75
Utah, s.l.	Utah	100,000	10	325,000	Dec. '10	0.02

Mining Companies—United States—(*Continued*).

Name of Company and Situation.		Shares. Issued.	Par Val.	Dividends. Total to Date.	Latest. Date.	Amt.
Utah, c.	Utah	1,562,599	10	11,487,238	Dec. '11	0.75
Utah Con., c.	Utah	300,000	5	7,050,000	Nov. '11	0.50
Valley View, g.	Colo	1,000,000	1	240,000	Dec. '10	0.04
Victoria, g.s.l.	Utah	250,000	1	207,500	Mar. '10	0.04
Vindicator Con., g.	Colo	1,500,000	1	2,407,500	Oct. '11	0.03
Wolverine, c.	Mich.	60,000	25	6,840,000	Oct. '11	4.00
Work, g.	Colo	1,500,000	1	172,500	July '08	0.00
Yak, s.l.	Colo	1,000,000	1	1,417,685	Oct. '10	0.04
Yellow Aster, g.	Cal	100,000	10	1,061,879	Aug. '07	0.20
Yukon Gold, g.	Alas	3,500,000	5	3,412,500	Dec. '11	0.07½

‡Includes $200,000 refunded on stock.

Coal, Iron, Industrial and Holding Companies.

Name of Company and Situation.		Shares. Issued.	Par Val.	Dividends. Total to Date.	Latest. Date.	Amt.
Amalgamated, c.	Mont	1,538,879	$100	$65,887,641	Nov. '11	$0.50
Am. Ag. Chem., pf.	U. S.	181,530	100	9,860,040	Jan. '12	1.50
Am. Cement	Penn	200,000	10	1,388,000	July '10	0.10
Am. Coal	Md	50,000	25	2,647,187	Sept. '10	0.75
Am. Sm. & Ref., com.	U. S.	500,000	100	21,000,000	Oct. '11	1.00
Am. Sm. & Ref., pf.	U. S.	500,000	100	39,375,000	Oct. '11	1.75
Am. Smelters, pf. A	U. S.	170,000	100	6,800,000	Dec. '11	1.50
Am. Smelters, pf. B.	U. S.	300,000	100	9,750,000	Dec. '11	1.25
American Coal	Md	50,000	25	2,722,187	Sept. '11	0.75
Butte Coalition, c.	Mont	1,000,000	15	4,700,000	Nov. '11	0.25
Cambria Steel	Penn	900,000	50	13,960,000	Nov. '11	0.62½
Central C. & C., com.	Mo	51,250	100	3,328,750	Oct. '11	1.50
Central C. & C., pf.	Mo	18,750	100	1,644,059	Oct. '11	1.25
Consolidated Coal	Ill.	50,000	100	425,000	Oct. '10	1.50
Consolidation Coal	Md	190,247	100	19,602,741	Oct. '11	1.50
Crucible Steel, pf.	Penn	244,365	100	11,607,333	Dec. '11	1.75
General Chem., com.	U. S.	81,513	100	4,046,018	Dec. '11	1.50
General Chem., pf.	U. S.	100,000	100	7,755,000	Oct. '11	1.50
General Dev. Co.	U. S.	26,000	100	2,769,000	Sept. '10	5.00
Guggenheim Expl.	U. S.	207,933	100	12,610,603	Oct. '11	2.50
Inter'l Nickel, com.	U. S.	115,826	100	4,268,810	Dec. '11	4.00
Inter'l Nickel, pfd.	U. S.	89,126	100	3,208,433	Nov. '11	1.50
Inter'l Sm & Ref.	U. S.	100,000	100	1,900,000	Dec. '11	2.00
Jeff. & Clf. C & I., pf.	Penn	15,000	100	1,087,500	Aug. '11	2.50
Lehigh Coal & Nav.	Penn	482,956	50	20,603,348	Nov. '11	1.00
National Carbon, pf.	U. S.	45,000	100	3,543,750	Nov. '11	1.75
National Lead, com.	N. Y.	206,554	100	6,556,968	Dec. '11	0.75
National Lead, pf.	N. Y.	243,676	100	24,150,476	Dec. '11	1.75
Old Dominion, c.	Ariz	293,245	25	2,040,311	Oct. '11	0.50
Penn. Salt	Penn	60,000	50	15,458,000	Oct. '11	3.00
Phelps, Dodge & Co.	U. S.	449,346	100	16,185,456	Dec. '11	4.50
Pittsburg Coal, pf.	Penn	297,010	100	14,023,797	Oct. '11	1.75
Pocahontas C. C., pf.	W. Va	28,000	100	588,000	July '11	3.00
Republic I. & S., pf.	U. S.	204,169	100	11,457,816	Oct. '11	1.75
Sloss-Sheffield, com.	Ala.	100,000	100	2,608,000	Dec. '10	1.25
Sloss-Sheffield, pf.	Ala.	67,000	100	5,158,650	Oct. '11	1.75
Standard Oil	U. S.	970,000	100	736,222,000	Sept. '11	6.00
Texas & Pacific Coal	Texas	25,000	100	1,895,030	June '11	1.50
Uni. Metals Selling	U. S.	50,000	100	11,550,000	Jan. '11	5.00
U.S. Steel Corp., com.	U. S.	5,083,025	100	148,156,622	Dec. '11	1.25
U.S. Steel Corp., pf.	U. S.	3,602,811	100	300,031,036	Nov. '11	1.75
U.S. S., R. & M., com.	U. S.	486,044	50	3,728,745	Oct. '11	0.50
U.S. Sm., R. & M., pf.	U. S.	351,010	50	9,559,997	Oct. '11	0.87½
Va.-Car Chem., com.	U. S.	279,844	100	1,609,563	Aug. '11	1.75
Va.-Car. Chem., pf.	U. S.	180,000	100	17,940,000	Oct. '11	2.00
Warwick I. & S.	U. S.	148,671	10	750,744	Nov. '11	0.40
Westmoreland Coal	Penn	60,000	50	9,240,000	Oct. '11	2.50

v Plus 15% stock dividend July, 1910. *w* Includes 2 per cent. accumulative, October, 1910. *x* Stock dividend $6,130,000 March, 1909. *y* Stock dividend $2,866,950 January, 1910. *z* Includes stock dividend 10 per cent., March, 1910.

Canadian, Mexican and Central American Companies.

Name of Company and Situation.		Shares. Issued.	Par. Val.	Dividends. Total to Date.	Latest. Date.	Amt.
Amparo, g.s.	Mex	2,000,000	$ 1	680,000	Nov. '11	0.03
B. C. Copper	B. C.	591,709	5	384,611	June '11	0.12½
Buffalo, s.	Ont	1,000,000	1	1,317,000	Dec. '11	0.10
Coniagas, s.	Ont	800,000	5	2,840,000	Nov. '11	0.45
Crown Reserve, s.	Ont.	1,768,814	1	3,537,628	Dec. '11	0.05
Crow's Nest PassC.Co.	B. C.	248,506	25	2,182,864	Mar. '11	0.25
DominionCoal, com.	N. S.	150,000	100	4,650,000	Apr. '11	1.00
Dominion Coal, pf.	N. S.	50,000	100	4,390,000	Aug. '11	3.50
Dos Estrellas, g.s.	Mex	300,000	0.50	6,780.000	Jan. '11	2.50
El Oro, g.s.	Mex	1,147,500	4.85	9,211,486	Dec. '11	0.36
Esperanza, s.g.	Mex	455,000	4.85	11,189,796	Oct. '11	0.36
Granby, s.l.c.	B. C.	148,496	100	4,183,630	June '11	1.00
Guanajuato D., pf., s.	Mex	10,000	1000	274,356	Jan. '11	3.00
Hedley Gold	B. C.	120,000	10	504,000	Dec. '11	1.00
Kerr Lake, s	Ont.	600,000	5	3,720,000	Dec. '11	0.25
La Rose Con., s.	Ont.	1,498,407	5	2,427,241	Oct. '11	0.10
Le Roi No. 2, g.	B. C.	120,000	24.30	1,399,680	Aug. '11	0.48
Lucky Tiger Com., g.	Mex	715,337	10	1,231,834	Nov. '11	0.05
McK.-Dar. Sav. s.	Ont	2,247,692	1	1,708,244	Oct. '11	0.10
MinesCo. of Am. (new)	Mex	1,700,000	10	742,500	Oct. '11	0.15
N. Y. & Hond. Ros.	C. A.	150,000	10	3,060,000	Mar. '11	0.30
Nipissing, s.	Ont.	1,200,000	5	6,840,000	Oct. '11	0.37½
Peñoles, s.l.g.	Mex	80,000	25	5,011,687	Mar. '11	1.25
PeregrinaM. & M., pf.	Mex	10,000	100	328,656	Sept. '10	3.50
Pinguico, pf., s.	Mex	20,000	100	420,000	Apr. '10	3.00
Right of Way Mns‡s.	Ont	1,685,500	1	202,260	Dec. '11	0.02
Rio Plata	Mex	373,437	5	289,40[illegible]	Dec. '11	0.10
Temiskaming, s.	Ont.	2,500,000	1	1,009,155	Oct. '11	0.03
Tem. & Hud. Bay, s.	Ont.	7,761	1	1,474,590	Nov. '11	3.00
Trethewey, s.	Ont.	1,000,000	1	761,998	July '11	0.10

*Previous to reorganization, $5,258,881.
‡Previous to January, 1910, $324,644.

INDUSTRIALS

W. H. McIntyre, formerly fourth vice-president, Equitable Life Assurance Co., is now first vice-president and general manager of Manning, Maxwell & Moore, incorporated.

Oliver Continuous Filter Co. is moving to Hooker & Lent Building, San Francisco, Calif. Increase in business requires more commodious quarters. The company will occupy suite 704-5-6-7, 503 Market St.

H. K. Porter Co. has just issued a circular showing that the company has gone into the manufacture of large and heavy locomotives and gasoline locomotives which is its latest specialty, as well as light engines, which it has been building for the past 45 years.

The Salt Lake office of the Sullivan Machinery Co. has removed from the Dooly Building, in which it has been located for the last five years, to the Kearns Building, room 704, thereby securing much needed additional space for the conduct of its business in that city. M. G. Doll is local manager.

Walter B. Snow announces the recent addition to his staff of Sidney G. Koon, for four years editor of "International Marine Engineering," and later metallurgist, Jones & Laughlin Steel Co., and also the addition some time since of John S. Nicholl, lately with the New York Edison Co., and formerly acting manager for F. W. Horne, importer of American machinery, Yokohama, Japan. Both are members of the American Society of Mechanical Engineers.

Nevada has evinced a power to "come back" as a mining state, if the business now being done by the Oliver Continuous Filter Co., is any criterion. In the last few months it has installed the following filters, and it is claimed that over 90% of the filters used in the State of Nevada are Olivers: Nevada Hills Mining Co; Nevada Wonder Mining Co.; Mexican Gold & Silver Mining Co.; Rawhide Queen Mines Co.; Farmers Mining Co.

Among recent orders for equipment received by the Dorr Cyanide Machinery Co. are eight duplex classifiers and eight thickeners for the new mill of the Tonopah-Belmont Development Co., at Tonopah, Nev.; a classifier and thickener for the Portland Gold Mining Co., of Colorado Springs, Colo., and two classifiers and one thickener for the Katchkar Gold Mining Co., Perm Government, Russia. This will make three Dorr classifiers and four Dorr thickeners in use by this company.

Rock Drills. Bulletin. Form 4108, issued by Ingersoll-Rand Co., 11 Broadway, New York City. Catalog of four pages, descriptive of the B-104 Sergeant rock drill, which is a machine specially adapted for driving small headings, stoping or similar work requiring a light and small, but powerful machine. This drill has a 2½-in. diameter cylinder and will drill a 1- to 1½-in. diameter hole to a depth of 20 in. without change of steel. Bulletin shows duplicate parts of the drill and also gives ful specifications and details.

Under the title "Technology and Industrial Efficiency," the proceedings of the Congress of Technology, held in Boston last April at the Massachusetts Institute of Technology, have been published in a volume of about 500 pages. Some 70 papers are included, and these form together a valuable and uptodate record of the present state of industrial science, and a presentation of some of its problems and probable solutions. The six sections into which the congress was divided are represented by papers on: "Scientific Investigation and Control of Industrial Processes," "Technological Education in its Relations to Industrial Development," "Administration and Management," "Recent Industrial Development," "Public Health and Sanitation," "Architecture."

The Deane Steam Pump Co., Holyoke, Mass., in a new bulletin, D-205, gives an extensive discussion of the construction of its triplex power pumps of the vertical, double-acting type. It explains the advantages of the triplex machine over other forms of power pumps, principal among which is that the combined discharge from the cylinders is practically uniform in quantity and pressure. The analyzed dissection of the pump, pointing out the features of design that are the outcome of this company's 40 years' specialization in the building of power pumping machinery, will be found of particular interest. The simplicity durability, accessibility and solidity of the Deane triplex power pump are points that are specially emphasized. The pumps listed range in size of cylinders from 2x3 in. to 13x12 in., and in capacities from 11½ to 2475 gal. per min. Some nine different styles of these pumps are illustrated and tables of dimensions, capacities, speeds, etc., are given of each. The pumps are arranged for belt or gear drive from any power source.

Weadon & Rockfield, who have been representing the Jeffrey Manufacturing Co. for a number of years in the southern part of California, south of Bakersfield and in the western portion of Arizona, have changed the name of their concern to the California Machinery & Equipment Co. W. V. Lewis, formerly president of the Lewis Supply Co., of Kansas City, Mo., is president of the new concern and has located in Los Angeles. J. W. Rockfield is secretary and treasurer of the new concern. It will specialize in designing and equipping alfalfa milling plants, portable track, contractors' equipment as well as elevating, conveying and power-transmission machinery; also being designing engineers of brick and cement machinery and placer mining plants. The company will also act as direct representative for the Jeffrey Manufacturing Co., Columbus, Ohio. Both of the abovementioned gentlemen are familiar with the Jeffrey products, Mr. Rockfield having formerly been connected for ten years with the Jeffrey main office and works.

B. W. Traylor, vice-president of the Traylor Engineering & Manufacturing Co. is moving from New York to Allentown, Penn., where is located the works of his company. This change of residence is due to the great increase of work by the company mentioned, and Mr. Traylor's presence at the plant is desirable on account of the necessity of pushing through the many large contracts which it now has on hand.

The Traylor Engineering & Manufacturing Co. reports a large increase in its business, some of the recent orders for crushing rolls being as follows: One set 60x30-in. rolls for the H. S. Kerbaugh Co.; two sets 54x24-in. rolls for the St. Louis Smelting & Refining Co.; one set 54x24-in. rolls for the Canada Ore Corporation; three sets 42x16-in. rolls for the Butte & Superior Copper Co.; one set 42x16-in. rolls for the Miami Copper Co.; one set 42x16-in. rolls for the Canada Ore Corporation; one set 36x16-in. rolls for the St. Louis Smelting & Refining Co.; two sets 36x16-in. rolls for the International Pavement Co.; one set 30x14-in. rolls for the El Rayo Mining & Reduction Co.; one set 30x14-in. rolls for Northern Ore Co.; one set 18x10-in. rolls for the La Dura Mining & Milling Co.

The new Herreshoff furnace has a cylindrical steel shell placed vertically, lined with red brick, and in this shell brick hearths are placed horizontally one above the other. Passing down through the center of these hearths is a double vertical hollow shaft. Attached to this shaft are one or more arms at each shelf, and replaceable rabbles, or teeth, are slipped on these arms. On one shelf they are placed at such an angle that the revolving arms plow and turn the roasting ore over in a regular way, making it travel from the center of the hearth outward. From there it discharges through proper openings onto the hearth below, where the teeth are placed at a proper angle to turn and plow the ore from the outside toward the center of the furnace, where it again drops as shown in the vertical section. This operation is repeated until the ore finally discharges through an opening placed at the outer edge of the bottom hearth. The life of the central shaft and hearths, as well as the teeth, is prolonged by bringing about internal cooling. This cooling is accomplished by air, which is forced into the bottom of the shaft as shown in the drawings, and then delivered through the central shaft, from which it passes in multiple at once into all the arms. After cooling the arms it returns into the annular space between the inner and outer shaft and finally discharges at the top of the outer shaft. The air for combustion is admitted over the lower hearth through ports in the outside shell and passes upward through the furnace in a direction counter current to the roasting ore, escaping through the gas outlet.

TRADE CATALOGS

New York Engineering Company, 2 Rector street, New York. Catalog. Empire gold dredges. Illustrated, 68 pages, 6x9 inches.

The C. O. Bartlett & Snow Company, Cleveland, Ohio. Catalog No. 32. Triumph drop forged chains. Illustrated, 32 pages, 6x9 inches.

Ernst Wiener Company, 46 Church street, New York. Circular. "Carrying the Burdens of the World." Industrial railway equipment. Illustrated.

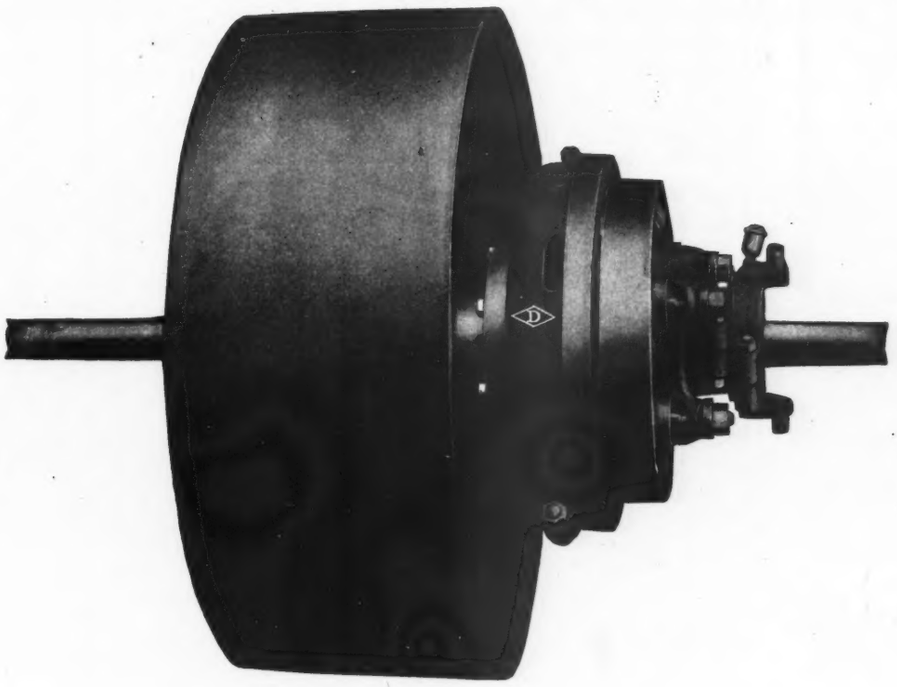
Byron Jackson Iron Works, San Francisco, Cal. Bulletin No. 40. Multiple-stage turbine and series centrifugal pumps. Illustrated, 48 pages, 6x9 inches.

American Air Compressor Works, 26 Cortlandt street, New York. Catalog No. 19. Fairhurst air compressors, vacuum pumps, air receivers, etc. Illustrated, 30 pages, 6x9 inches.

Carnegie Steel Company, Pittsburg, Pa. Catalog. Steel mine timbers. Illustrated, 40 pages, 8½x10 inches. Pamphlet. Steel mine timbers—data and tables for use of mining engineers. Illustrated, 58 pages, 5x7½ inches.

The Goulds Manufacturing Company, Seneca Falls, N. Y. Bulletin No. 101. Triplex plunger pumps. Illustrated, 12 pages, 8x10 inches. Bulletin No. 103. Vertical, single-acting triplex plunger pumps. Illustrated, 20 pages, 8x10 inches.

DODGE



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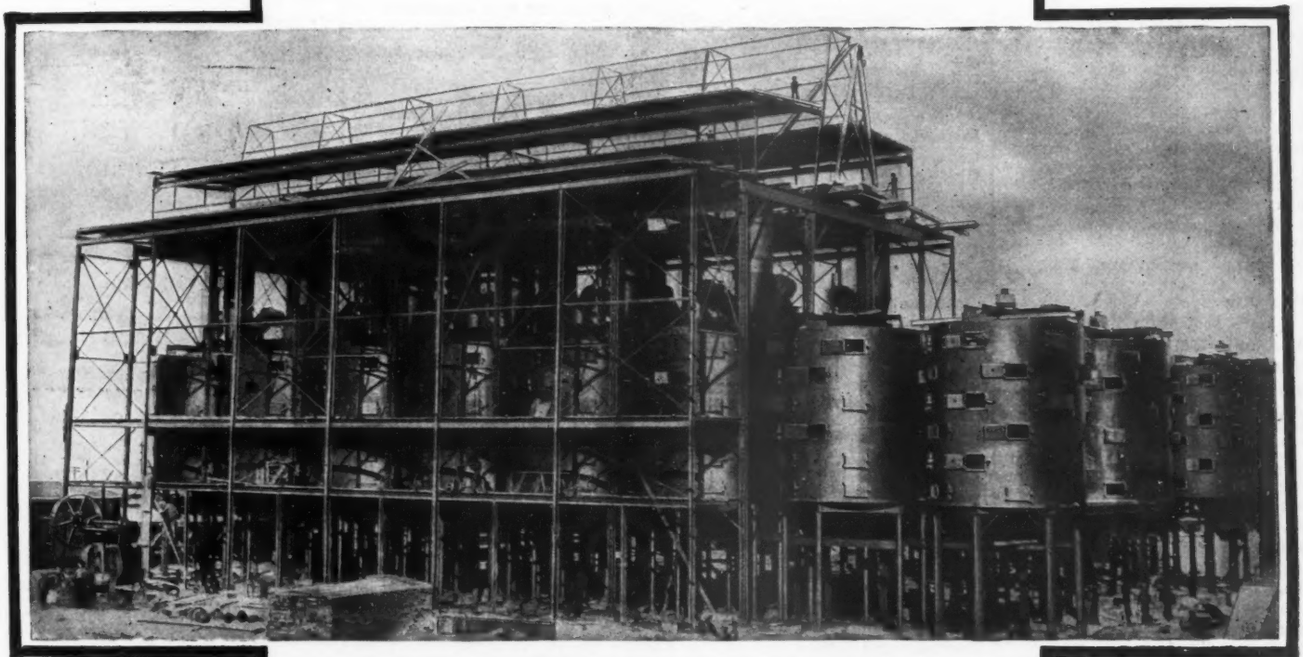

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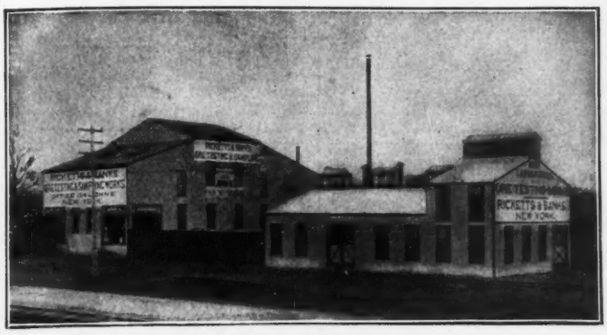

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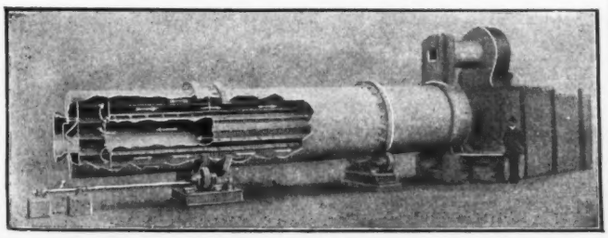

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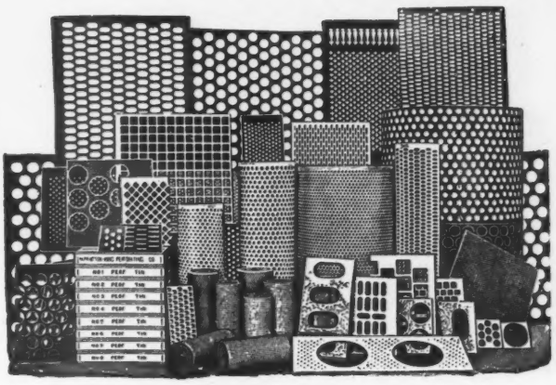

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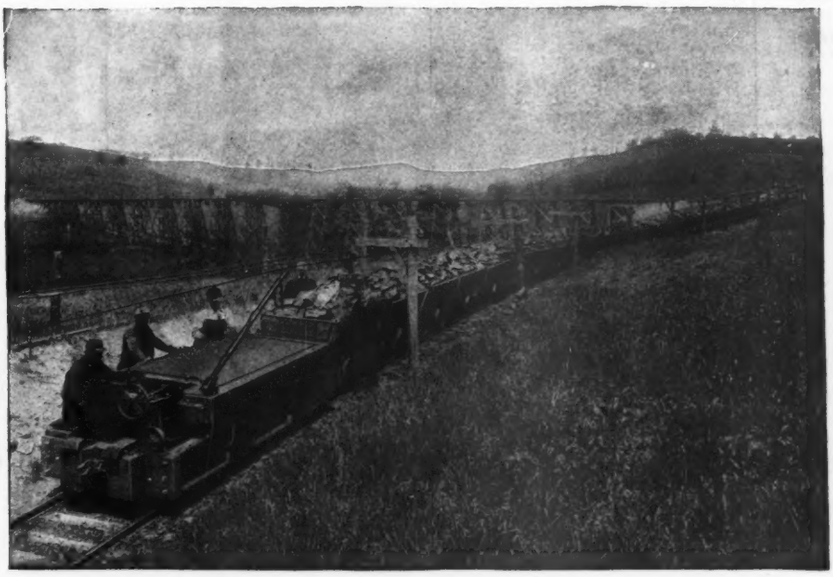

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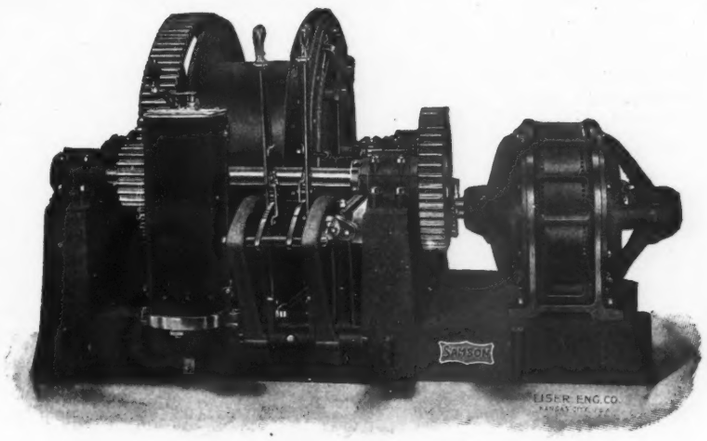
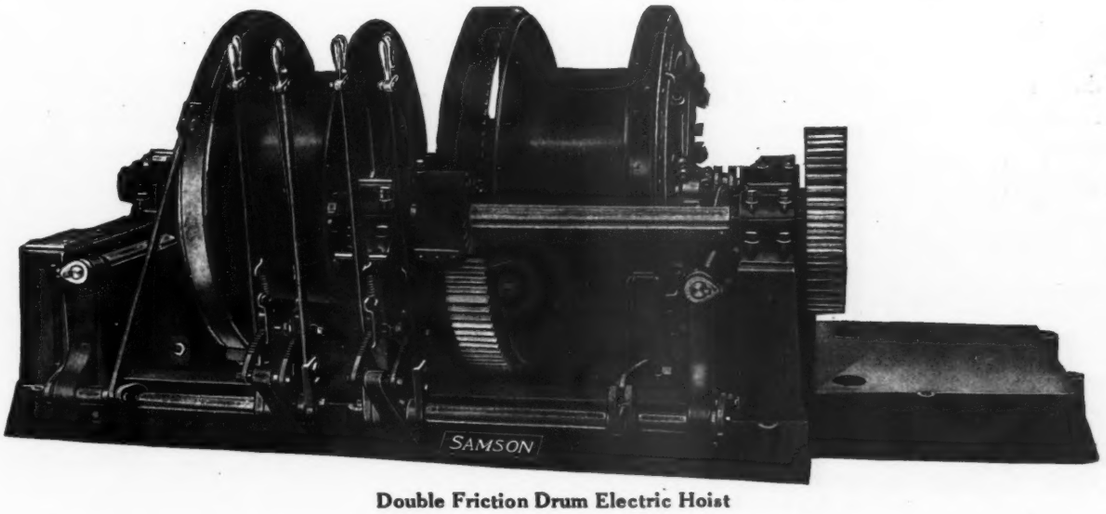


Single Friction Drum Electric Hoist



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Any load up to twenty tons can be lifted by one man with a Triplex Block,—two men can lift forty tons.

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Write for "A Pipe Threading Miracle."

THE TOLEDO PIPE THREADING MACHINE CO., TOLEDO, O.

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from
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Company
PACIFIC COAST HEADQUARTERS
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FOR THE MECHANICAL
TRANSMISSION OF POWER
Elevating,
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Moments with the Advertising Manager

A Department for Subscribers Edited by the Advertising Service Department of The Engineering and Mining Journal

New Year is the time to look backward—and forward.

This is as it should be—and this year is no exception.

We have a whole lot to be thankful for, notwithstanding the mist and uncertainty that have enveloped business for some time.

Things are never as bad as they seem—the dip is never so deep as it looks.

This is a great big country. No one but the statisticians in Washington realizes the magnitude of our products.

There cannot be far-reaching, unlimited hard times until the man next to the soil is affected. He is prosperous now.

Many of the large concerns of this country are busy. The ship-building industry is booming. Business in Europe is good. In England it is at the high-water mark.

Here, in future, there will be less boom and more straight hustle. There will be less scramble for anything that can be used and more intelligent seeking for the better things.

The great law of supply and demand is always working. Sooner or later we are bound to feel its full effects.

Machinery of all kinds must be used—it is needed to economically manufacture everything used by civilized man.

* * *

The golden rule is in better working order now than ever before.

The extremists at both ends of the social scale are fast losing their grip.

It is dawning on the man behind the machine that money does not make a man an ogre—that an employer has responsibilities and rights.

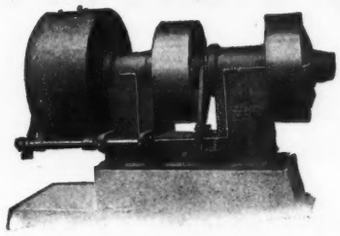
Capital is more and more realizing that "a man's a man for a' that"; that the rank and file are honest, want to be fair, although at times misled.

But the good fellowship that comes from contact one with another, the exchange of ideas, the putting of oneself in the other fellow's place, all tend to dispel the gray clouds, all work for the brotherhood of man which the New Year season typifies.

Let us forget our troubles during this holiday season, and then each come back to his task with a clearer perspective, an effort that is strong, clean, hopeful and energetic.

All things will be better in 1912. Better manufacturing, better mining, better selling and better advertising. It's to be a year of progress.

The New Crushing Principle



embodied in the

Symons Disc Crusher

PREVENTS
- wearing the crushing members in grooves.
- clogging when crushing to small sizes.
- waste of power in packing.
- expensive renewals.
- excess of slimes.

and

PROVIDES
- for crushing 4½″ ore ½″ at one operation.
- for great capacity.
- for taking up wear.
- for quick adjustment.
- economy in power.
- exceptional durability.

SUPERSEDES CRUSHING ROLLS

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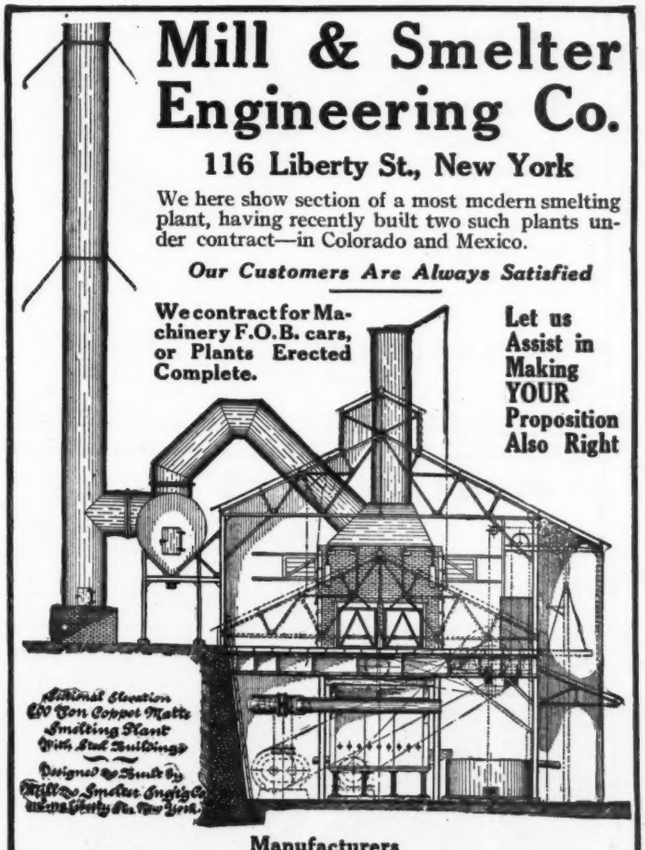

Manufacturers

Milling And Smelting Machinery

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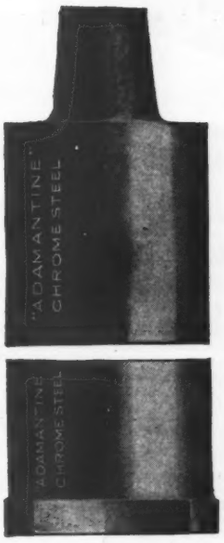
CHROME, N.J., U.S.A.

TRADE **Adamantine** MARK

Chrome Steel Shoes And Dies

(Hydraulic Forged)



These Shoes and Dies are hot-pressed under enormous pressure, in a Hydraulic Forging Press, which process insures a metal of absolutely equal density, and with the "Adamantine" standard of quality for toughness, the result is *long service with even wear to the end.*

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"ADAMANTINE" is our registered Trade Mark. To avoid substitution order by that name.

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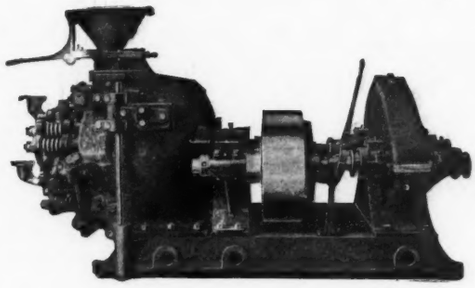

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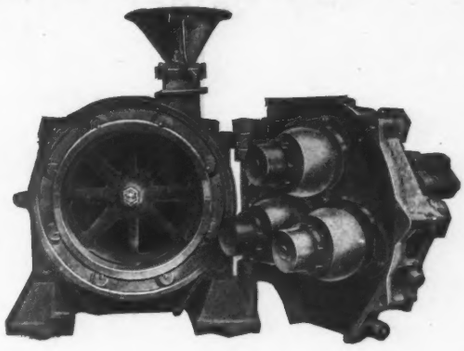

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6 to 10 Tons Per Hour to 40 Mesh.
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Our Small Mill has half above output with half the power.

A Ring and Three Roll shells make an old mill new.

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IN the selling section of this paper are advertisements of the *representative* concerns catering to the mining industry. Consult these pages.

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SHOES FOR ANY SIZE WOOD PIPE TO WITHSTAND ANY PRESSURE

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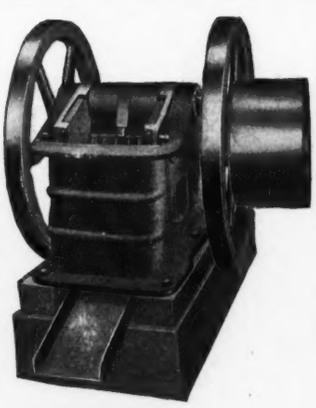

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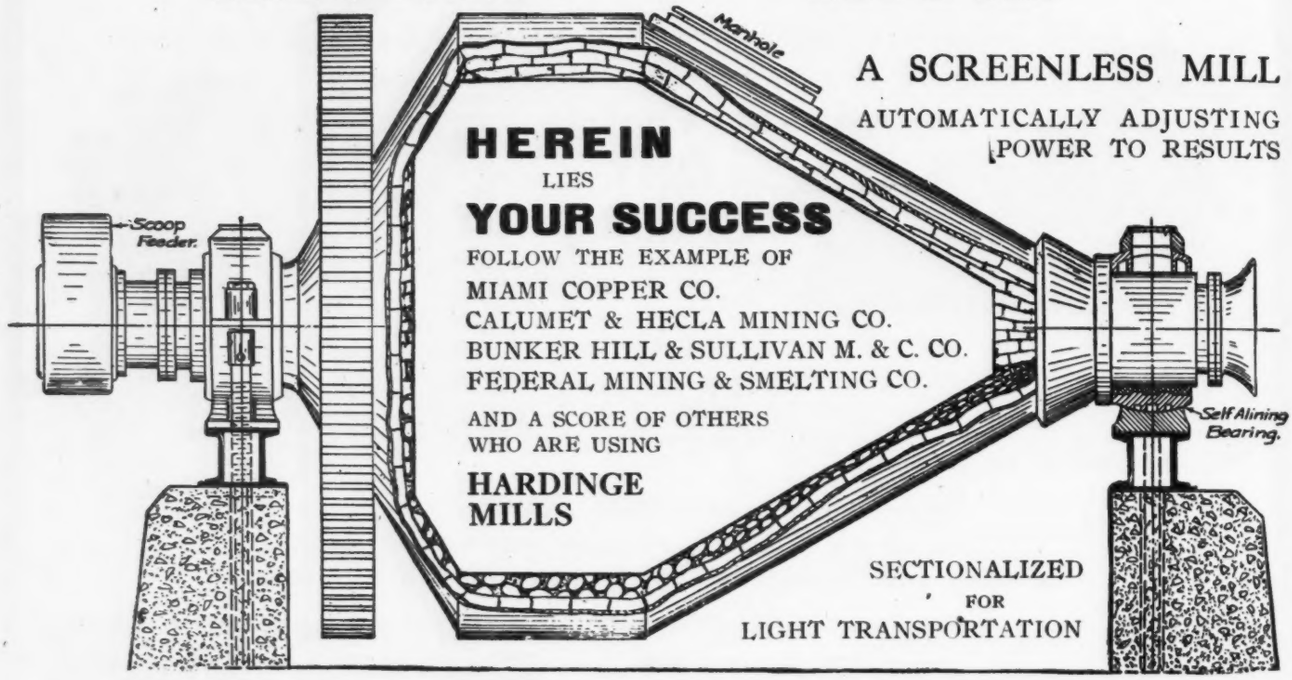

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For fine crushing of ores for amalgamating or cyaniding by agitation

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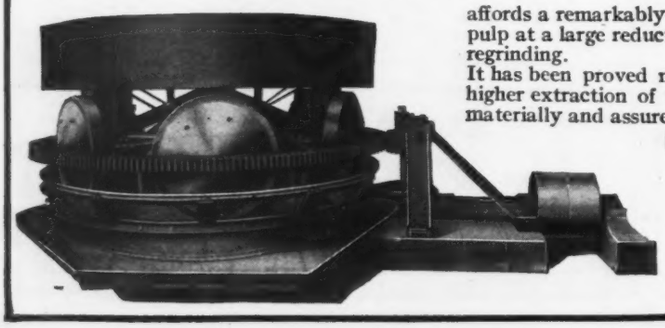

affords a remarkably economical method of reduction which assures a satisfactory pulp at a large reduction in cost below the combination method of stamping and regrinding.
It has been proved most effective wherever tried—repeatedly making possible a higher extraction of values. Moreover, it reduces the initial cost of plant very materially and assures *very* low power consumption and repair costs.
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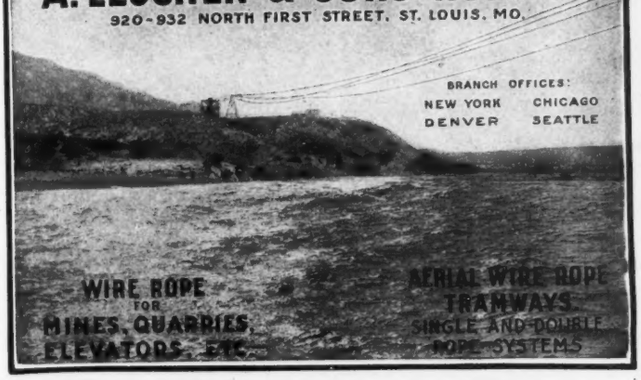

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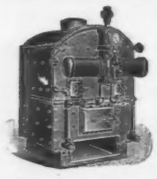

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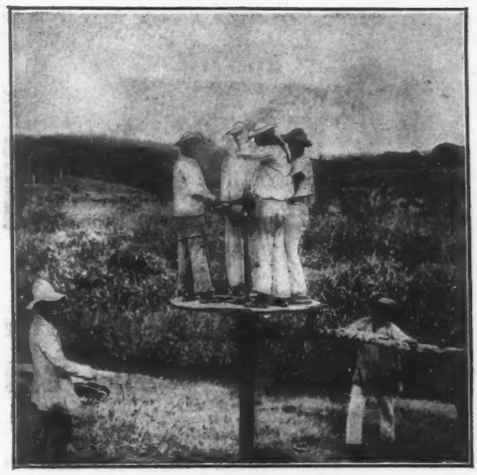
We guarantee the "Empire" Drill to do more work, faster work, cheaper work and more accurate work, than any other prospecting drill made.



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Special Shovels for Stripping Over-burden

This Company has perfected a new type of Revolving Steam Shovel that successfully meets the strenuous requirements of stripping over-burden, whether this be from coal, iron ore, or other similar material.

These Shovels are equipped with extra long booms for stripping wide cuts and dumping the excavated material at great heights and distances, to permit the mining of the uncovered material without any of it being under the spoil bank.

By a *single* operation the over-burden is taken from the bank on one side and deposited far enough over on the other to eliminate the *usual duplicate* handling.

The only crew required is that for the shovel itself.

Circular 250 gives full information—write for it.

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A New Belt Conveyor Roll That Enables More Efficient And Economical Handling Of Ores—

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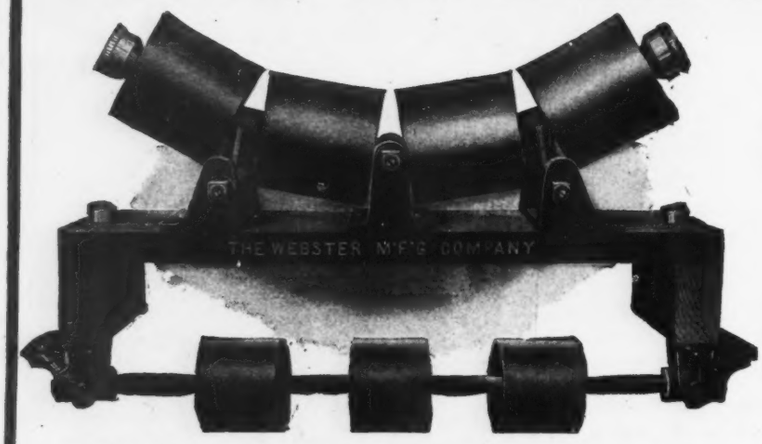

Permits Different Degrees of Concentration and the Use of a Heavy Belt.

You will find it advantageous to look into this new Conveyor Roll and let us plan your Conveyor work for you.

IT HAS— Three Supports for Four Pulleys—Outer Supports Adjustable
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Pulleys Run on Continuous Steel Tubes—Grease Reaches All Pulleys
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NO rubber coated conveying belt is claimed to stand up under heat. ¶ On this score alone, the new "Special Black" Leviathan has a decided advantage. A belt than can convey *hot* ore, for instance, as well as wet ore, beats out the rubber belt in range of service. ¶ But if this same belt has surface and texture that more effectively meet cutting and wear than the rubber belt, the advantage is two-fold. ¶ Both these facts are true of the New "Special Black" Leviathan compared with the older type of conveyor belt. The plies of

The New "Special Black" Leviathan

are impregnated in manufacture with a compound which protects the canvas fibres from drying action by hot ore, sand or lime, rotting action of continual wet, and from acid drip or fumes. ¶ This belt is the most serviceable and thus truly economical buy for any sort of belt conveying job. Let us send you information.

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For the conveying of ore, coal, rock and similar materials, the Robins Belt Conveyor is superior in efficiency, economy and durability. As the manufacturers of the Pioneer Belt Conveyor and leaders in this field for over fifteen years, we cordially invite correspondence from those having conveying problems to solve.

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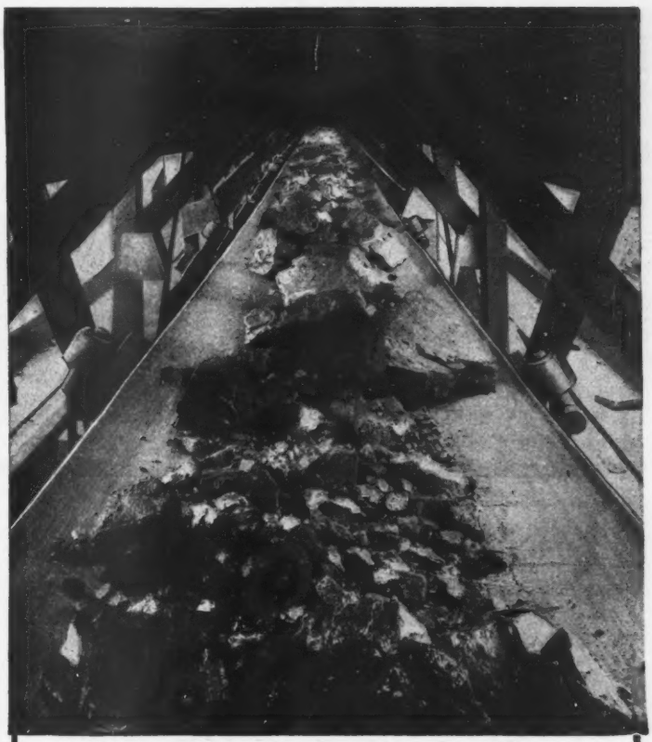

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Rubber Belt Conveyors designed for handling ore, as well as coal and other materials.

Photo shows 36″ Belt Conveyor with a capacity of 350 tons material per hour, requiring only 7 H. P. to operate same.

Our catalog No. 67 illustrates numerous situations where the Jeffrey Belt is successfully solving conveyor problems in Mining and Smelting Plants.

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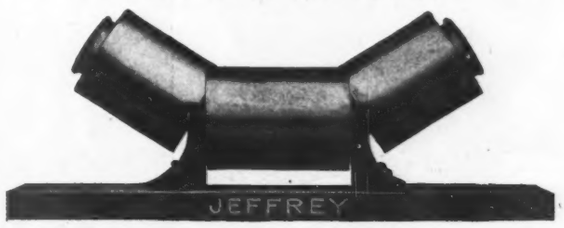
Jeffrey Idlers are built for service. Illustration shows a Jeffrey 3-Pulley Troughing Idler.



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Weighs materials while traveling on Conveyor by setting up an electric current which ebbs and flows *precisely* with the ebb and flow of material passing over the conveyor. Our one-piece meter keeps step with the current and ticks off tons by mercury contact.

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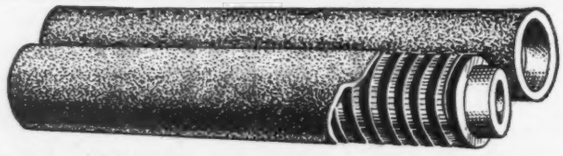

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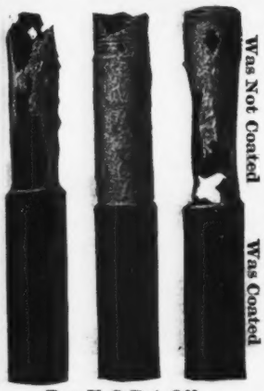

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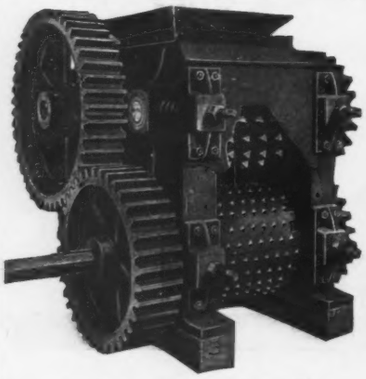

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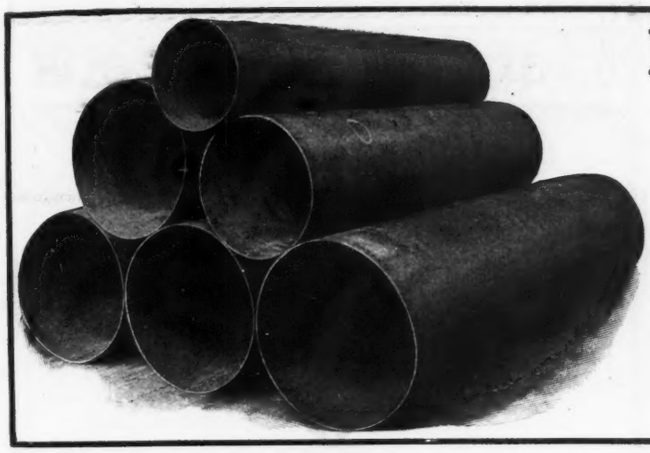

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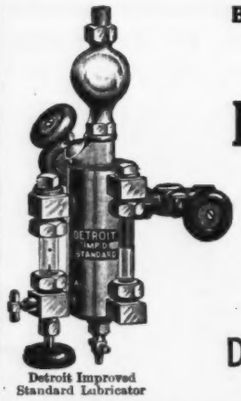

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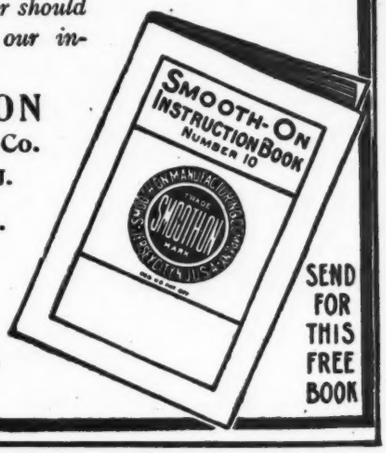

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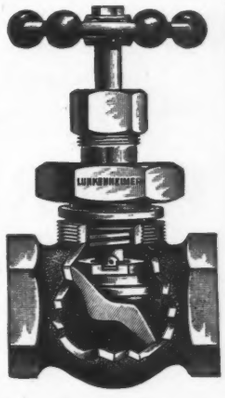

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It gives you an indication of the strength with which *all* Porter Locomotives are built.
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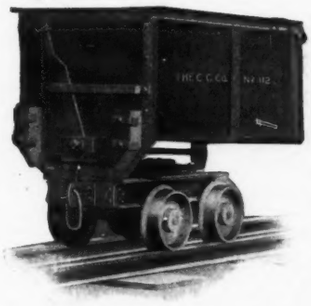

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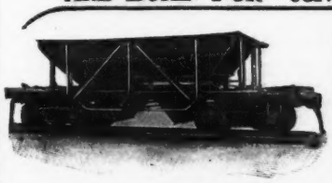

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Any capacity from 150 to 350 cu. ft.

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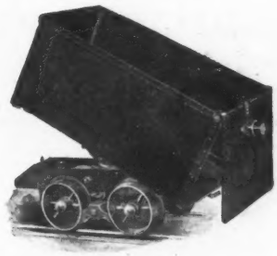

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Built in 100 different weights and capacities of which the following are a few:—

	Capacity	Wt. Class A & C	Class B
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No. 3	12 " "	600 "	530 "
No. 16	14 " "	770 "	680 "
No. 30	16 " "	790 "	700 "
No. 36	18 " "	820 "	720 "
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They are the result of 8 years careful experimenting—regular laboratory work—to determine the exact angle that gives best results under certain conditions. The result is an unequaled efficiency and economy.

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We manufacture screens, elevators, conveyors, crushers and friction hoists.

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removes impurities from
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Excessive impurities and limited Water Supply no drawback. Large Output. Low Cost. Small Power required. **Simple, Durable, Efficient.** Easily and cheaply erected and operated anywhere.

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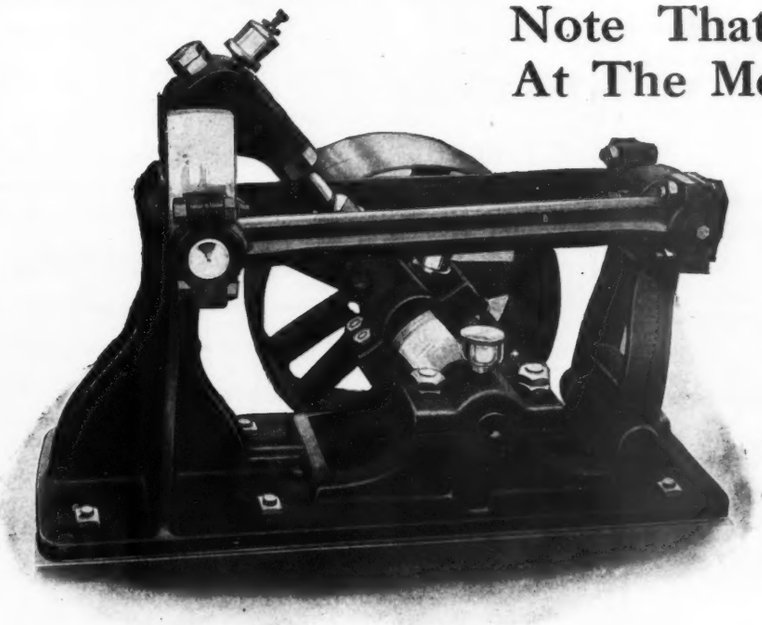
The Motion Machine Of The
Braeckel Concentrator

Note That Motion Is Not At The Mercy Of A Spring



The motion operates with one-quarter horsepower.

On account of its splendid and solid construction it cannot possibly get out of order.

Operators who have used the Braeckel Table tell us that this motion machine is the finest for the purpose and the easiest in operation that they have ever seen.

Write for Bulletin describing the Braeckel Table and its advantages.

The Braeckel Concentrator Comp'y
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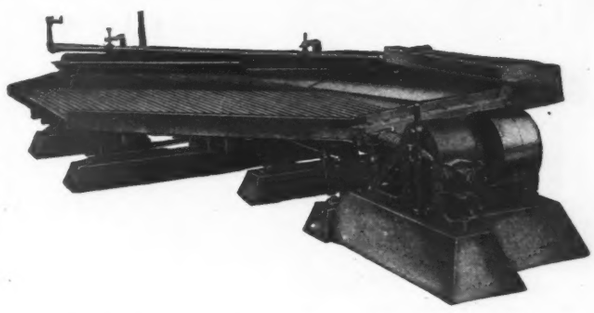
A handsomely illustrated and descriptive Catalog will be sent you on request. Write for it.



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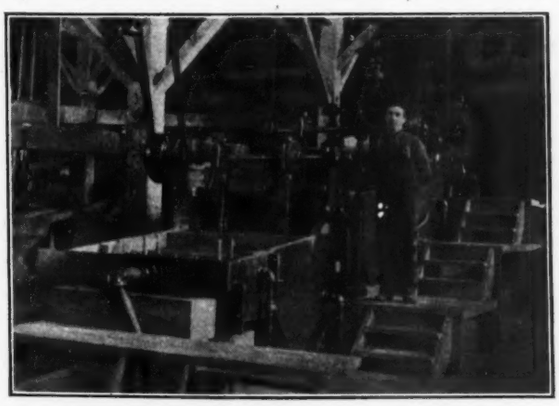

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WOODBURY JIG

replaced 30 jig compartments of the Harz type and two hydraulic Classifiers.

Moreover this splendid capacity was secured without crowding and without sacrificing recovery.
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Write—we will gladly go into full details.

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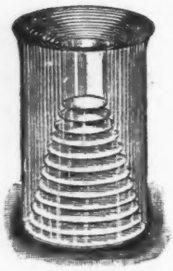
Best Hammered Platinum Ware.



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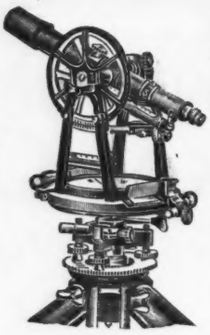

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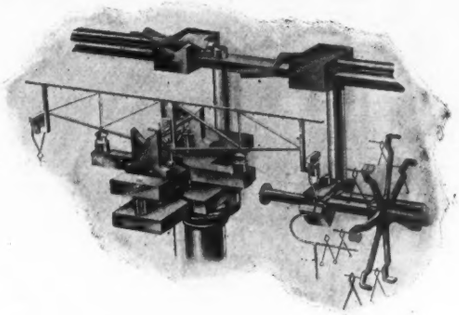

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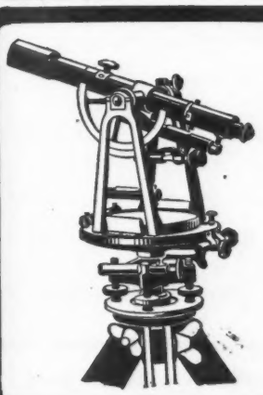

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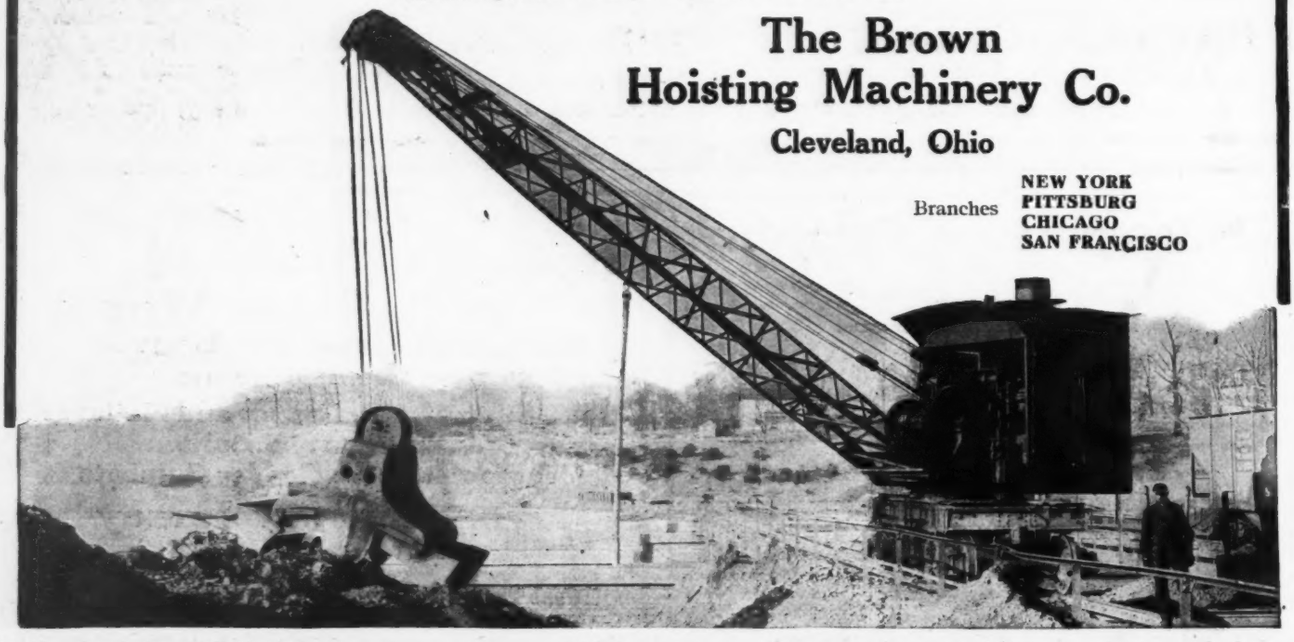

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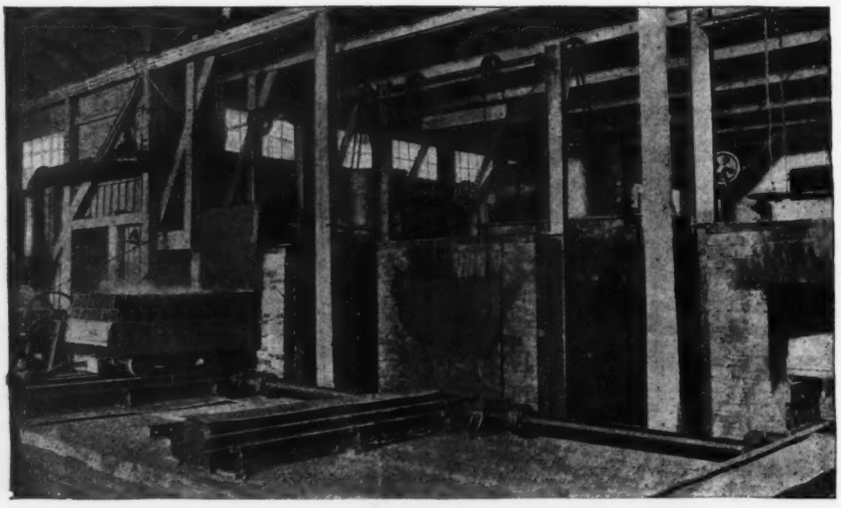

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We make a specialty of machine banded wood pipe for mines and city systems—it does not corrode—is easily transported and laid—pressures up to 400 ft. head.

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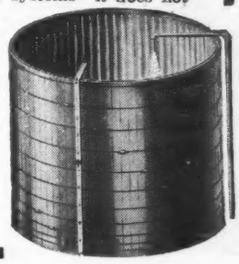

Address nearest office for catalog or information

PACIFIC TANK & PIPE COMPANY

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"I commenced using your valves 24 years ago, and have some of the original valves still in use" recently wrote a manufacturer in Massachusetts.

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And they are the most economical, because they can be so easily kept in good repair at slight expense and less labor.

Purchase valves bearing the Jenkins Bros. Trade Mark and you are protected by a positive guarantee of satisfactory service

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Two "Frisco" 100-ton wreckers, equipped throughout with 1¼ inch Yellow Strand. One wrecker is working at each end of a wreck at Tilikina, Okla.

Samples of wire rope were recovered from the ruins of Pompeii.

And yet, today, in the twentieth century, wire rope is only coming into its own.

Possibly this is because it took the science of modern manufacturing methods to make a wire rope that is absolutely uniform and reliable.

Such a rope is Yellow Strand.

It is a high quality rope made without one concession to cheapness but honest-all-through and giving its user full value in *service*.

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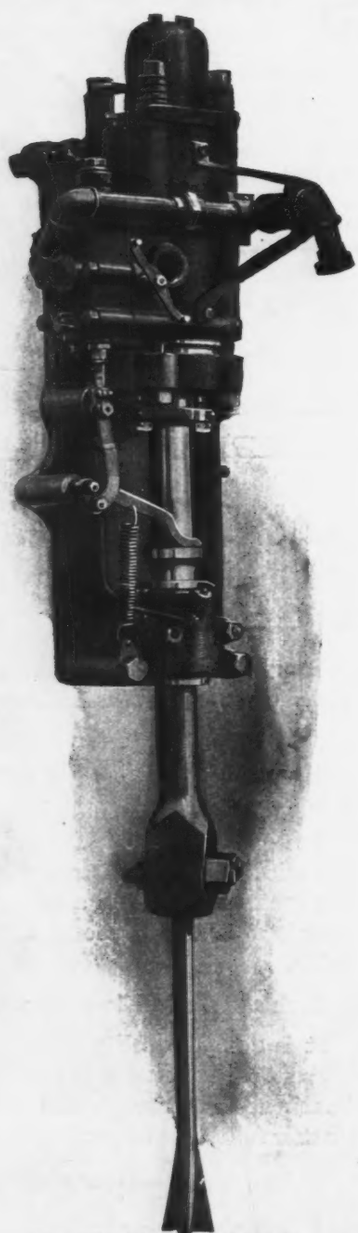
There's A Sullivan Drill



Class "UM" Auto Traction Drill

just suited to excavate rock most rapidly and at least cost, under *your* working conditions.

¶ If you must have holes 50 ft. deep in limestone, the drill at the left, on its auto-traction mounting, will bore them for you five inches in diameter, at a rate of 12 inches per minute. It has a 7-inch cylinder and a vertical feed of 20 feet.

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¶ Between these extremes there are Sullivan Drills in more than 15 sizes and styles. You may be confident that whichever of these is recommended to you by the engineers of this company, that one will be the *most efficient drill* you can select for your particular work, whether it be quarrying, tunneling, sinking, raising, drifting or stoping.

Bulletins 266 a-b-c-d

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